CLAUDIA: A CASE HISTORY OF INTENSIVE BEHAVIOR ANALYSIS AND BEHAVIOR CHANGE

By

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To my friends and teachers of the science of human behavior,

Claudia and Hank.

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There are so many people to whom I am indebted that in thanking some individuals, I run the risk of oversight. Two notable omissions are, however, intentional: I have instead dedicated this work to them.

I would first like to thank my committee, Drs. Marc Branch, Mark Goldstein, James Johnston, John Newell, Dorothy Nevill, and Henry Pennypacker. They provided guidance and encouragement in a project that had considerable personal, as well as professional, meaning to me. In addition, I am indebted to Drs. Calvin Adams and Ogden Lindsley for their aid in aspects of design and preparation, and to Ms. Vickie Barkmeier for her invaluable assistance in editing and preparing the manuscript.

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Families are not limited to those to whom one is related. My thanks to the entire Pennypacker family for the home away from home they made for me.

There are also two men whose impact on me was profound and whom I wish to remember here, the late Zelig Sered and William Resnick.

I would like to extend special thanks to a special group of people. I am lucky and proud to have been a part of the loving, caring team effort that was the STARS Program.

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Department: Psychology

The cost, effectiveness, and cost benefit of applying a variety of intensive behavior change procedures were evaluated in a state residential institution for the retarded. Effectiveness was measured in terms of appropriate changes in response frequencies; costs were equated with time and money; and cost benefit was derived by the cost-avoidance resulting from the demonstrated increase in adaptive behavior. The study occurred over a period of approximately two and one half years and included over 6000 training and testing hours. The subject was a nonambulatory, self-abusive, profoundly retarded female adolescent. Training and/or analysis was conducted in five areas, as follows:

Decrease of self-abusive behavior (rumination): Analysis of diet indicated that rumination frequency was at least partially dependent on liquid density and time of liquid intake.

Changes in these parameters reduced rumination rate from 1.2 to 0.6 responses per minute. Addition of a rumination-contingent lemon juice squirt, followed by a cheek-hold procedure, decreased the frequency to 0.003 ruminations per minute. A weight gain of 45 pounds accompanied the decrease in rumination.

Ambulation training: The following classes of behavior were instated (none were present prior to training): independent walking, up to one mile per day at over 100 steps per minute; independent chair use (into and out of chairs), at 7.0 times per minute in speeded practice trials; ascending and descending stairs, at 25 stairs per minute; crossing obstacles, at 6.0 times per minute in speeded practice trials.

Eating and related skills training: Independent scooping with a spoon was increased from 0.6 to 8.0 scoops per minute. Use of a cup was taught to terminal performance in practice trials of 8.0 correct uses per minute versus one or zero spills per five minutes. Training in cafeteria tray-carrying reduced the frequency with which materials on the tray were spilled from five times per minute to about once per minute, at which time totally independent tray-carrying was possible.

Motor skills training: A variety of skills was taught, including playing catch, with a terminal performance of 70 correct throws versus one wrong throw per ten minutes. Tricycle riding was also trained; assists to steer the tricycle were decreased from five to less than one per minute.

Assessment of visual functioning: A modification of the constant-stimulus psychophysical method was used in a non-verbal discrimination task involving a white cube (S+) and a white cube with a black circle (S-). Lifting S+ and depositing it in a container resulted in reinforcement, and touching S- was followed by a brief timeout. The diameter of the S- circle was gradually reduced from 0.40 cm to 0.04 cm. From the resulting 75 percent correct threshold value of 0.08 cm, acuity ratio was calculated as 20/130 (both eyes).

Periodic follow-ups indicated that most major induced changes maintained, particularly walking, independent eating, reduction in rumination rate, and weight gain.

Discussion included assessment of factors related to maintenance of behavior change and a limited analysis of increased social behavior as a by-product of intensive training. In addition, qualitative and quantitative techniques were suggested for assessing the relative effectiveness and efficiency of training procedures and for determining maximal skill levels in retarded persons.

CHAPTER I
CASE HISTORIES AND THE PRESENT STUDY

Introduction

This paper is a report of two and a half years of the intensive study and training of Claudia, a profoundly retarded adolescent living in Sunland Center, Gainesville, Florida.[1] The data included in the report were collected routinely as part of Claudia's participation in the STARS (Start Training Appropriate Responses to Stimuli) Program, a training project funded by Public Law (PL) 89-313.[2]

The material chronicles behavior analysis and behavior change efforts in a variety of areas-- self-abusive behavior, motor skills, daily living skills, and determination of visual acuity threshold-- and covers many specific behaviors. Since the analysis and modification of each behavior was highly dependent on the concurrent existence and rate of many other behaviors, the report is best presented in case history, roughly chronological form, rather than as a series of separate behavior analyses and behavior modification projects.

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[1]Permission to use the data reported herein was granted May 26, 1978. A copy of the release form is on file in the Training Department Office, Sunland Center, Gainesville, Florida.

[2]The contents of this report do not necessarily reflect the views of the Department of Health, Education and Welfare.

The paper is divided into three major sections. Chapter One revolves around the concept of the case history, tracing the evolution of the case history in psychology and particularly in behavior analysis. This section considers the relationship between behavior analysis and behavior change, and concentrates upon reports of disabled (retarded, autistic, etc.) individuals. Chapters Two and Three are Claudia's case history. As indicated above, the material is presented in approximate chronological order. The case history is subdivided according to training milestones, rather than into time periods of equal length. Traditionally-labeled sections--"setting," "procedure," etc.-- are omitted; all information that would normally appear in those sections is included in the narrative account to permit a more readable text.

Case Histories

Definition of Case History

A case history is an account of the intensive study of some portion of an individual's life. It is usually either a description of change (rehabilitation) efforts for a problem or a set of problems, or is a complete description or analysis of a set of target behaviors. When behavior analysis components (experimental manipulations designed to establish a functional relation among stimuli and responses) are included, the term "case study" may be used. However, the two terms are frequently used synonymously (e.g., Ullman & Krasner, 1965), with good reason: It is difficult to establish the point at which

description of behavior and behavior change ends and the experimental analysis of behavior begins (Johnston & Pennypacker, in press). For present purposes, several comments will suffice to demonstrate that behavior change/behavior analysis are best viewed as constituting a continuum; a particular case history may include data from any part or parts of that continuum.

The commonest form of treatment described in case histories involves instituting a change in the subject's environment and observing whether behavior change follows. If the behavior changes, especially in the desired direction, the therapist is likely to conclude that there is a relation between the procedure and the observed change. The experimental reasoning is weak and clearly belongs at the "behavior change" end of the continuum. However, for therapeutic purposes the goal has been accomplished. The therapist may also wish to explore the alleged relation further, for a variety of reasons and in a variety of ways. The therapist may, for example, want to test the strength of the therapeutic effect, examine the degree to which the effect is maintained in different situations, and demonstrate necessity/sufficiency of various aspects of the procedure. The therapist's activities are now shifted toward the "behavior analysis" end of the continuum.

The case studies described below cover a large portion of the continuum. The degree to which each may be considered analytic depends upon the nature of the data-- diary,

narrative log, observation schedule, behavioral frequency, etc.-- and upon the "experimental design" employed by the author. The designs vary by circumstance, ranging from "I wonder what my client will do if I suggest. . .," to highly sophisticated and incisive strategies as those described in research texts (e.g., Sidman, 1960; Johnston & Pennypacker, in press).

No effort will be made to rate the case histories' analytic value or quantify the continuum. In fact, many histories lack all but the crudest and most inferential data and reasoning, but are valuable for other reasons such as providing pleasurable reading and, occasionally, inspiration.

The role of analysis has become crucial for at least one group of case history producers and consumers-- the group included under the rubric of "behavior modification" (Kazdin, 1978). For this group, case histories of the most analytic form-- studies of individuals conducted explicitly to discover the laws of behavior-- comprise a portion of the experimental literature. In such experimental studies, emphasis is generally placed more upon graphic displays of data than upon narrative account, but the results may certainly be viewed as case histories. In addition, non-research-oriented modifiers or therapists regularly integrate various levels of analysis into their therapeutic endeavors. The amount and kind of analysis is-- or should be-- dictated by the needs of the case at hand.

The following sections provide a sample of the scope and flavor of case histories, and a brief discussion of the potential and merits of the histories. Heaviest emphasis is placed upon the role of the case history in behavior analysis, especially in the training of disabled individuals.

Earliest Case Histories in Child Development

While earlier accounts of the behavior of individuals are available, Tiedmann's (1787/1927) work is recognized as "the first attempt to make a series of scientific observations on the behavior of young children" (Tiedmann, 1787/1927, p. 206). Tiedmann's goal was to provide data for teaching "the development of the mind's powers"; he noted that there was "a dearth of exact and sufficiently numerous observations upon children's souls" (Tiedmann, 1787/1927, p. 205). To rectify the situation, he regarded detailed study of the individual as the best solution, with the following caveat:

> I grant that what has here been observed cannot be taken as a general law, since children . . . progress variously . . .; but at least it informs us of one among the possible rates of progress . . . . When we shall have several such records it will be possible by means of comparison to strike an average for the common order of nature. (Tiedmann, 1787/1927, p. 206)[1]

Beginning in 1787, Tiedmann observed and "experimented upon an infant from birth to age two years, six months." His

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[1]Johnston & Pennypacker (in press) describe the development of the view that social phenomena are subject to a natural law of averages, and the growth of statistics based on this view.

report was completely narrative and chronological, with extensive notes concerning the first several days and more infrequent observations-- about one per several months, as relevant-- thereafter. His data were not quantitative, but his observations and "experiments" enabled him at least to begin analyzing behavior. For example, in tracing the development of the sensation of taste, Tiedmann notes:

> Even the special sensations of taste . . . were not yet distinguished (at two days of age) . . . . This appeared conclusively on August 25. On account of an indisposition the boy was given a medicine of unpleasant taste and pungent odor; he took it without any sign of objection, like his usual food. . . . [T]hirteen days after his birth the boy showed some traces of acquired ideas, in clearer sensations and affections of his soul. Some medicines were now unwillingly taken, with evident reluctance, yes, were even spewn forth again, but not immediately, rather upon being tasted several times. (pp. 208-209)

Tiedmann frequently strayed beyond the limits imposed by his data to draw highly inferential conclusions, looking as he was for "proof of the superior original activity of the human soul" (p. 211). Nevertheless, his work was a dramatic, early demonstration of the potential of detailed study of the individual; i.e., the case history.

Although Tiedmann's study was perhaps the first published attempt at a scientific case history, the educator Pestalozzi had published a diary several years earlier (1774) documenting his efforts to teach his young son. While Tiedmann was interested in the description and analysis of various "naturally unfolding" behaviors, Pestalozzi's diary was an early prototype

of case histories involving the description of individual intervention strategies. Although Pestalozzi was not concerned with detailed analysis of his procedures, he carefully observed the effects of instituting the procedures. He thus obtained at least a no-intervention vs. intervention analysis:

> I left him no choice between his task [boring, unhappily attended reading lessons] and my displeasure with the consequent punishment of being confined in a room by himself. After this he gave way and learned his lessons merrily. (Pestalozzi, 1774, in Green, 1912, p. 29)

Pestalozzi was also aware-- but did not pursue the study-- of primary reinforcement. He maintained a supply of cooked apples which he distributed to his son, Jacques, "now and then." Initially, Jacques wanted to eat all of them at once, but his father refused, using the opportunity to induce Jacques to study, telling him, "if he learnt well I would give him some more. He left the spoon alone," and proceeded with his lessons (p. 34).

Pestalozzi's diary, among his other works, made important contributions to the field of education. In addition to providing many examples of effective and ineffective instructional techniques (he recognized the value of reporting failure as well as success), the diary was a forerunner of the many current individual education plans, prescriptions, etc.

Shortly, after Tiedmann's and Pestalozzi's pioneering efforts, Itard published the results of nearly five years of studying and training Victor, the "Wild Boy of Aveyron"

(1801, 1806, translated by Humphrey & Humphrey, 1962). Victor, who was probably abandoned at about age three to live alone in the forests of France, was the best-known but not the first-reported feral child. At least ten such cases were reported between the mid-sixteenth and eighteenth centuries, and Linnaeus classified them as a distinct human species, Homo Ferus (Locke, in Pringle-Pattison, 1924; Rousseau, translated by Masters, 1964). However, the early reports of feral children were sketchy and unreliable; Itard's several publications are combined to form the first complete case history of such a child. First Developments of the Young Savage (1801) and A Report Made to his Excellency the Minister of the Interior (1806) combine Tiedmann's attempts at scientific analysis and Pestalozzi's description of educational intervention, to constitute what is arguably the finest case history ever written. The work will be considered in detail in a later section; it is mentioned here to note its place in the evolution of the case history.

During the remainder of the nineteenth and early twentieth centuries, case histories similar to those described above continued to appear. Darwin (1877), for example, published A Biographical Sketch of an Infant, a narrative based on the diary he kept of his son's first six months. The narrative is quite similar in form and content to Tiedmann's earlier work. Singh & Zingg in 1942 published an account of Singh's work in the 1920's with several feral children, and included a review of the earlier feral cases (Hahn, 1978).

Diaries and narrative logs thus comprised the earliest data of the child development field (Arrington, 1939; Mussen, Conger, & Kagan, 1969; Lytton, 1971). Although behavioral time-sampling schedules became the most popular method of collecting data during the 1930's (Hartman, 1978), the case history remained a major vehicle for detailed study of the individual. For example, Barker's "psychological ecology" was centered around the "specimen record," or "narrative account" (Barker & Wright, 1949). Piaget also used such accounts to support his theories of child development, although narrative records did not comprise the majority of his data (Flavell, 1963).

Psychological Narratives

The rise of psychoanalysis created great interest in treatment-oriented case histories or "psychological narratives." Due to Freud's prolific writing, the case history assumed an integral place in psychoanalytic literature (e.g., Freud, 1955). Freud published six case histories based upon various types of information. "The Wolf Man" was a discussion of childhood neurosis, stemming from psychoanalysis sessions conducted while the patient was in his twenties. Another case history was based upon an autobiography; Freud never saw the subject. Freud used the case histories as proof of various aspects of his theories and as a setting for theoretical expositions. "Dora" for example, written much like a novel, demonstrated the value of dream interpretation in analysis (Jones, 1955).

As the number of psychotherapeutic orientations grew, so did the number of applications of the case history. In addition to appearing in professional journals and books, case histories and life stories were dramatized and appeared in the popular literature, with appeal to professional and public tastes alike. Dibs in Search of Self (Axline, 1964), Three Men (Evans, 1966), Sybil (Schreiber, 1974), and Children with Emerald Eyes (Rothenberg, 1977) are recent examples; their style and popular appeal were foreshadowed by Beers' autobiographical A Mind That Found Itself (1908).

Quantitative Data, Analysis and Learning Theory

Behaviorism. The foregoing case histories are, with several exceptions, primarily treatment-oriented and descriptive. The emergence of behaviorism in the early 1900's (Watson, 1924) gave rise to a new type of case history--studies of individuals that incorporated, or even focused upon, analysis and/or quantitative data.

Watson and Rayner (1920), in their famous study of Albert and the white rat, recorded trial-by-trial progress in conditioning and generalizing fear. Using similar methods, Jones (1924) studied and treated another young boy's fear of various objects. Jones examined the effectiveness of gradually "fading in" the feared stimuli and noted the degree to which Peter responded to similar objects not involved in the deconditioning manipulations.

Skinnerian psychology (Skinner, 1938, 1953) placed quantitative studies of individuals firmly within the realm of

scientific inquiry. Experimental methods and recording techniques, developed in the animal laboratory, were soon applied to the analysis of human behavior (e.g., Fuller, 1949; Azrin & Lindsley, 1956; Bijou, 1955, 1957, 1958) and continue to constitute an integral portion of the experimental literature (e.g., Barrett, 1965; Ferster & DeMyer, 1965; Findley, 1966; Emurian et al., 1978). These purely analytic endeavors, published in experimental format, are nevertheless highly detailed studies of individuals. As such, they may be correctly considered case histories, belonging at the "analytic" end of the continuum discussed earlier.

Behavior therapy. People involved in the treatment of behavior disorders quickly saw the relevance of the work of Watson, Skinner, and other researchers, and applied learning principles to clinical practice. In the late 1950's and 1960's, Wolpe, Lazarus, Eysenck, Shapiro, and others used case studies extensively as "proof" of and support for the validity of their various behavior therapy theories and techniques (e.g., Wolpe, 1958; Shapiro, 1966). Shapiro in particular supported the notion of single-case study for demonstrating therapeutic control of behavioral disorders.

The early case material heavily emphasized treatment and did not concentrate upon analysis: No-treatment vs. treatment comparison was the common form of case study. For "proof," the therapists relied upon large numbers of cases, or "reproductions" of the therapeutic effect. Lazarus (1963), for example, summarized the results of 126 cases of treatment of severe neurosis.

The relative merits of using this form of case history in lieu of more highly analytic studies, group or single-subject design, were hotly debated (especially Breger & McGaugh, 1965, 1966; Rachman & Eysenck, 1966). The most reasonable conclusion rests upon the degree of analysis evidenced by a given case history: The studies reported by the behavior therapists did not offer conclusive proof of the effectiveness of the therapy techniques employed, but neither were the cases irrelevant; they were highly suggestive demonstrations that stimulated more analytic endeavors (Ullman & Krasner, 1965; Kazdin, 1978).

Operant conditioning. In addition to practitioners of the behavior therapies described above, another group of researchers/therapists included by the label "behavior modifiers" are those who have concentrated their analysis and treatment efforts within the realm of operant conditioning or Skinnerian psychology. This group, too, has used case histories extensively for analytic and treatment demonstration purposes. The settings, subjects, and behaviors studied vary widely. Heaviest concentration has been upon autistic, schizophrenic/psychotic, and retarded individuals residing in institutions, but home and outpatient settings for studies of normal and disabled individuals are not uncommon (e.g., Williams, 1959; Rickard, Dignam, & Horner, 1960; Rickard & Dinoff, 1962; Ayllon & Azrin, 1965, 1968).

The studies have ranged from demonstrative, one-phase (treatment) -only reports (e.g., Ayllon & Michael, 1959;

Wolf, Risley, and Mees, 1964) to highly analytic research employing multiple reversals and examination of the target response under multiple conditions (e.g., Allen et al., 1964; Hart et al., 1964; Rickard & Mundy, 1965; Rekers & Lovaas, 1974). The most common type of case history is the "AB" or no-treatment vs. treatment design (e.g., Ayllon, 1963, 1965; Patterson, 1965; Wolf et al., 1965). The scope of the studies has generally been limited, covering one, two, or three target responses for periods of about two weeks to a year.

The salient feature of these case histories is the universal use of graphic displays of quantitative data regarding the target responses. Whether the studies are written in experimental or narrative format-- experimental is the more common-- the graphic data displays are generally the focus of the reports. The measurement indices vary greatly, including cumulative records, tallies, frequency, and most often, percent measures-- percent time engaged in responding, percent trials containing a response, etc. The graphic displays, or more precisely, the data contained in the displays, make these case histories distinctive among the histories discussed heretofore in terms of both behavioral description and analysis.

Studies of Retarded Individuals

Of particular interest to the present report are case histories and related analyses of the behavior of retarded persons, particularly the profoundly retarded.

In 1949, Fuller presented the first conclusive evidence that profoundly retarded individuals-- formerly designated "vegetative idiots"-- were susceptible to operant conditioning techniques. Fuller's study was not treatment-oriented; he demonstrated that a simple response, arm-raising, could be controlled by the contingent delivery of food. However, the implications for the treament of the profoundly retarded were enormous-- subsequent case histories demonstrated that such basic living skills as feeding, ambulation, and other motor behaviors could be taught to these persons formerly regarded to be completely untrainable (e.g., Rice & McDaniel, 1966; Rice et al., 1967; Barton et al., 1970; Loynd & Barclay, 1970). In addition to developing living skills, researchers and therapists demonstrated control of many of the undesirable behaviors that frequently accompany profound retardation: self-injurious behaviors, such as hand biting, head banging, and potentially lethal rumination (e.g., Kanner, 1957; Lang & Melamed, 1969; Sajwaj, Libet, & Agras, 1974; Cunningham & Linscheid, 1976; Harris & Romanczyk, 1976; Iwata & Lorentzson, 1976; Becker, Turner, & Sajwaj, 1978).

As is true of the studies reported in the previous section, case histories of retarded persons range from un-analytic to highly analytic. The majority are demonstrations that a particular procedure controls a particular response; the most common designs are no-treatment vs. treatment (AB) or no-treatment vs. treatment, with a reversal (ABAB). While demonstrating a functional relation between a procedure and

a behavior has been common, fine-grain analysis, such as isolating the specific elements of a procedure responsible for control, is rare (e.g., Horner & Baer, 1978). For example, the relevant aspects of overcorrection procedures, popular in controlling self-injurious behavior, are not known (cf., Epstein et al., 1974; Foxx & Azrin, 1973; Harris & Romanczyk, 1976). Likewise, some data indicate that appropriate behaviors emerge as aversive procedures decrease the rates of inappropriate behaviors, but the conditions under which and the degree to which this occurs are not well documented (e.g., Risley, 1968; Miller, Patton, & Henton, 1971). In comparison, there is clear indication that responses punished under one set of conditions may well occur at a high frequency in other (no-punishment) settings; even severely retarded individuals readily discriminate "safe" and "unsafe" conditions in which to emit the target behavior (Lovaas & Simmons, 1969; Rollings, Baumeister, & Baumeister, 1977).

Retardation case histories also evidence the same general scope as do other case histories by behavior analysts. An "intensive" study might included measuring and modifying three responses over the course of several months (e.g., Miller, Patton, & Henton, 1971). There are two notable exceptions to this generally limited scope. One is Stoddard's (1971) studies of Cosmo, a profoundly retarded microcephalic. Stoddard conducted laboratory studies of Cosmo for nearly ten years in an exploration of behavior analysis teaching

techniques. The studies were generally not treatment-oriented in that most behaviors were laboratory-specific with no attempt to generalized to Cosmo's living environment (e.g., visual discrimination; token training).

A second exception to the limited scope of case histories is Itard's description of the Wild Boy of Aveyron.

J. M. G. Itard and the Wild Boy of Aveyron

Although Itard worked with Victor, "L'enfant savage," from 1801-1806, the work is discussed here because of its importance to retardation, the experimental analysis of behavior, and the development of the case history. First Developments of the Young Savage (1801) and A Report Made to his Excellency the Minister of the Interior (1806; both translated by Humphrey and Humphrey in 1960) together form the first case history in behavior modification (Lane, 1976). As will be seen, the work differs from modern behavior analysis case histories in two respects. First, there is no graphic display of quantitative data; Itard's reports are in narrative form with all "data" described in the text. Second, the technical terminology obviously differs from today's. Nevertheless, The Wild Boy of Aveyron is arguably the finest case history ever written in terms of its scope (duration of training and range of behaviors trained) and in terms of the full natural integration of training and behavior analysis to maximize the subject's progress.

Victor was captured in the forest of Aveyron and brought to Paris in 1800. Authorities, especially Pinel,

estimated his age to be about twelve years and diagnosed his condition as incurable idiocy (Lane, 1976). Victor initially created a professional and public sensation in Paris, but the excitement soon abated since the boy was filthy, unmanageable, and "differed from a plant only in that he had, in addition, the ability to move and utter cries" (Itard, 1806/1960, p. 54). Itard, however, was struck by Condillac's comment that earlier feral children seemed to possess the intelligence required by their environments. Based upon this observation and upon the works of Locke and Rousseau, Itard reasoned that Victor was largely a product of his environment and that "he had only to find the proper social and physical education in order to supply the mental content that would make the boy a normal human being" (Itard, 1806/1960, p. viii).

Realizing that the weight of current medical opinion was against him, Itard requested and received permission to care for and train Victor. If the authorities were correct and Victor proved untrainable, Itard hoped to at least provide data to speak to the heredity vs. environment question. He surmised that,

> someone who, carefully collecting the history of so surprising a creature, would determine what he is and would deduce from what he lacks the hitherto uncalculated sum of knowledge and ideas which man owes to his education. (Itard, 1806/1960, p. xxiii)

Itard completely, successfully fulfilled neither aim: Victor never became a "normal human being," nor did Itard find a definitive answer to the nature-nuture question. But

Victor did acquire a behavioral repertoire that far exceeded the predictions of Itard's contemporaries, and Itard did illuminate the role of the environment in shaping behavior. In so doing, Itard changed the course of education, particularly for disabled persons. He placed the emphasis of education upon the individual, letting his pupil's behavior determine the course of instruction at every step along the way. The business of education, he felt, was "detecting the organic and intellectual pecularities of each individual and determining therefrom what education ought to do for him and what society can expect from him" (1806/1960, p. 50).

Itard's description of his work with Victor is fascinating and educational to the modern reader in a number of respects. Not the least of these is the way that Itard repeatedly reasoned out and applied behavior management principles. For example, one of Victor's earliest pleasures was going out to eat in town. Itard immediately saw the value of establishing reliable cues for this event and using them to reinforce behavior:

> I was careful to precede our expeditions by certain preparations he would notice; these were to enter his room about four o'clock, my hat upon my head, his shirt folded in my hand. These preparations soon came to be for him the signal of departure. I scarcely appeared before I was understood; he dressed himself hurriedly and followed me with much evidence of satisfaction. I do not give this fact as proof of a superior intelligence and there is not one who will not object that the most ordinary dog will do at least as much. But in admitting this intellectual

> equality one is obliged to acknowledge a great change, and those who saw the Wild Boy of Aveyron at the time of his arrival in Paris, know that he was very inferior on the score of discernment to this most intelligent of our domestic animals. (p. 23)

Itard was aware of and used a wide range of behavioral techniques, now labeled primary and secondary positive and negative reinforcement, fading, chaining, shaping, and punishment. He carefully observed the connection between his procedures and Victor's behavior, and was able to evaluate both his successes and failures. He was, for example, not surprised when his initial attempt to punish Victor's food stealing backfired:

> In order to repress this natural propensity towards thieving, I made use of chastisements applied during the very act. I reaped what society generally does reap from terror of its corporal punishments, namely, a modification of the vice rather than a real correction of it. Victor stole with cunning what until then he had been content to steal openly. (p. 93)

Of all Itard's contributions, perhaps the greatest was the way he used Victor's behavior to restructure continuously the training sequences. He invariably based a particular training procedure upon Victor's responses to earlier procedures. Into this scheme he skillfully incorporated true behavior analysis, teaching himself the laws of behavior and using the results of the analyses to remove obstacles to Victor's progress. While teaching Victor to match objects with pictures, for example, Itard realized that his original teaching device might well be inadequate: the pictures were

in a fixed order and Victor might thus be responding to the order rather than to pictorial aspects of the stimuli:

> To reassure myself I changed the respective positions of the drawings and this time I saw him follow the original order in the arrangement of the objects without any allowance for the transposition. As a matter of fact, nothing was easier than for him to learn the new classification necessitated by this change, but nothing more difficult than to make him reason it out. His memory alone bore the burden of each arrangement. I devoted myself then to the task of neutralizing in some way the assistance he drew from it. I succeeded in fatiguing his memory by increasing the number of drawings and the frequency of their transpositions. . . . I soon had material proof by experimenting with the transposition of the drawings, which was followed on his part by the methodical transposition of the objects. (pp. 39-40)

Itard's documentation of the extensive changes he produced in Victor thus stands as a model case history for behavior analysis and behavior change. After five years of work and despite some limits he could not exceed (e.g., he failed in his numerous attempts to teach Victor to speak), Itard had succeeded in transforming a savage into a civilized adolescent. From his behavioral methods and his continuous, informal analysis of the effects of his procedures came a model for training the untrainable.

Claudia: Rationale for and Technical Aspects of the Case History

Rationale

There are several reasons for writing Claudia's case history. The work is intended to fill a gap in the literature

of behavioral analysis and behavior change. Itard wrote a treatment-oriented case history of still-unparalleled scope and detail. Modern behavior analysts and therapists have added precise, quantitative measurement, graphic displays and, occasionally, sophisticated scientific inquiry methods. The scope of these recent efforts has, however, been far more limited than Itard's. The present case history is a combination of these aspects. It is a case history of training and analysis spanning two and a half years and covering virtually every relevant aspect of the subject's life, with each training sequence and subsequence guided, evaluated, and documented by direct quantitative behavioral measurement. Its scope is necessarily more limited than that of Itard's undertaking; likewise, every procedure employed and response trained was not subjected to as intense an analysis as has been seen in the most analytic modern case histories, with an exception: One aspect of Claudia's training was a largely analytic endeavor-- the determination of her visual threshold. Since this activity's emphasis was more analytic than treatment-oriented, the results are presented as a separate section.

Claudia's case history is the result of the juxtaposition of an individual in desparate need of intensive training and a federal grant, P. L. 89-313, that mandated such intensive training. The author was thus able to integrate direct behavioral measurement and formal and informal behavioral analysis techniques to do what he could to help Claudia.

Technical Aspects

As indicated earlier, all data reported herein were recorded routinely as part of Claudia's training. In this sense, the measurement, training, and analysis techniques used with Claudia were no different than those afforded the fifty-plus other clients trained by the STARS Program. Claudia merely received longer and more intense training than her peers, as she was the first client accepted into the program and her severe rumination necessitated extra training.

The data are primarily behavioral frequencies reported in responses per minute, with several exceptions, such as weight recordings. The data were recorded by the author and by full-time STARS Program employees; all data collection procedures were monitored by the author and other supervisory STARS staff. With the exceptions of baseline and other "hands off" periods, data collection generally occurred during the actual training session-- trainers used response-counters and stopwatches to record the behaviors in-session, rather than recording in pretest-posttest fashion. To maximize the accuracy and usefulness of the data, most responses recorded either produced "behavior products" (see Johnston & Pennypacker, in press) or else were discrete and unambiguous. The staff thus obtained accurate data with no disruption of the training sessions.

STARS data, including Claudia's, are generally recorded on the Standard Behavior Chart (Lindsley, 1968; Pennypacker,

Koenig, & Lindsley, 1972). Figure 1 is a typical chart from Claudia's training folder and represents the core of STARS record-keeping and training-progress procedures. The trainer conducting the session recorded the data both on the chart and in numeric form on a separate sheet. Supervisory staff checked the charts for accuracy on a monthly basis. Other records, such as attendance sheets and Sunland campus behavior checklists, were maintained, but the behavior charts account for the overwhelming majority of STARS client information. Figure 1 highlights conventions necessary to interpret the data reported in the following sections. The labels at the bottom of the chart are self-explanatory. Also note that data are recorded by calendar days, rather than by successive sessions; the advantages of displaying data against a real time dimension are well-documented elsewhere (see Pennypacker & Johnston, in press). The primary data are response frequencies, in responses per minute. Dots (.) generally represent correct or appropriate responses, the frequency of which trainers attempted to increase. "X's" generally represent incorrect or inappropriate responses, targeted for decrease. Exceptions are noted when relevant. Dashes (-) are "record floors" and denote the reciprocal of the amount of time during which data were collected. Frequencies of 0 are noted by placing the data point directly below the record floor. Since the frequency scale (ordinate) is logarithmic, the combination of frequency and record floors preserve the entire record--the distance on the log scale between the record floor and the 1/minute frequency line is the recording time in minutes;

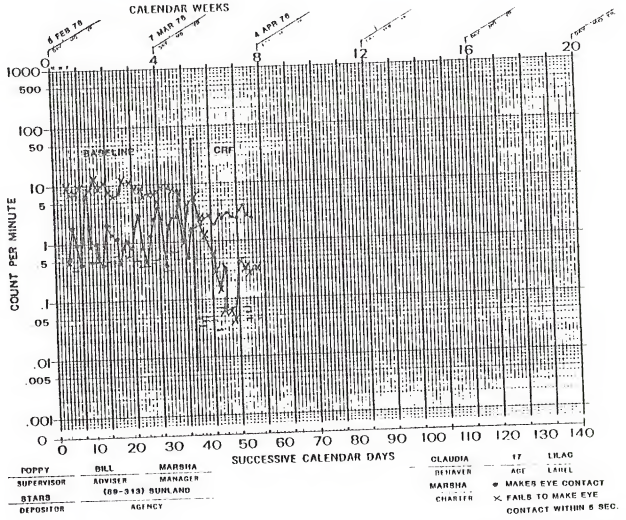

Fig. 1. Typical STARS Program behavior chart.

the distance between the record floor and its corresponding behavioral frequency is the response-count. "Phase lines," the vertical bars between sets of frequencies, denote changes in procedure or other environmental changes.

The charts in the case history have been slightly modified for greater clarity. Horizontal (days) and vertical (frequency) axes are identical to those on the Standard Behavior Chart, but the grid has been removed. All charts have been reduced to conform to editorial requirements. The charts are otherwise identical to those used and updated daily in routine client-training operations.

CHAPTER II

CLAUDIA: A CASE HISTORY OF INTENSIVE BEHAVIOR ANALYSIS AND BEHAVIOR CHANGE

Background: Claudia's First Seventeen Years[1]

From Home to the Institution

Claudia was born in Jacksonville, Florida, in November, 1958, a healthy seven pounds, three ounces. Her mother had had phlebitis during the pregnancy, but no other complications or diseases were noted. There was no family history of retardation.

At age two months, Claudia appeared to be allergic to milk, but was otherwise healthy. Her parents began to worry at three months: she was still healthy but seemed to be hyperactive and they noticed that her eyes were divergent and her tongue abnormally large. A month later, the doctor noted delayed bone development, but it was not consistent with cretinism. Her waking EEG was normal and several tests for PKU produced negative results.

The parents continued to be upset. During the following several months they observed that Claudia neither reached for objects nor held her bottle. She did seem to notice people

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[1]The information in this section was culled from administrative, medical, and cottage records. Details of Claudia's early training are sketchy and unreliable; hence, only the barest facts are presented here.

and things and laughed when her parents played with her, but she did not "socialize" very often. Her movements were jerky and the large tongue was continuously out.

At seven months, the parents insisted on a diagnosis. Neither PKU nor cretinism was the problem, responded the doctor, but Claudia was probably retarded. She was developing slowly, but not excessively so.

Several months passed, and doctor and parents realized the child was definitely retarded. They applied for Claudia's admission to one of the Sunlands, Florida's retardation institutions. The Sunlands were full, and Claudia was put on a waiting list. Eight months later she was re-evaluated and considered for placement at either the Gainesville or Orlando Sunland. Although she could walk only with complete support, Gainesville was the appropriate site: the doctor felt she would be walking unassisted within three years, and openings at the Orlando Sunland were reserved for cases with more severe ambulation problems.

In 1960, at age eighteen months, Claudia became one of the many "retardation, cause unknown" residents of Gainesville Sunland.

Life at Sunland

There is no record of formal training provided for Claudia during the next thirteen years. This is not surprising. The institution was overcrowded and woefully underfunded. Maintaining basic living requirements for the residents

devoured most of the budget; the remaining training monies had to be spent on the highest level residents, those able to benefit from extant teaching and therapy technologies. For the lower functioning residents, including Claudia, little could be done; even had training funds been available, these residents appeared to be untrainable.

Claudia was definitely, as the higher level clients put it, a "low grade." Her mental age at admission was six months, I.Q. 32; four years later she tested at mental age 7.4 months, I.Q. 9 (Cattell Intelligence Tests). Subsequent attempts to test her using the Stanford-Binet were recorded as "FTI" (formal testing impossible), and she was classified at the lowest level on the Adaptive Behavior Scale. In short, she was growing older but developing no new behaviors.

In 1973 she was re-diagnosed as Down's Syndrome. The diagnosis was only temporary-- tests revealed that her chromosomes were normal. Unbeknownst to her, she was again "profoundly retarded, cause unknown."

That same year, reports of self-injurious behaviors appeared in Claudia's records. None of the behaviors-- chewing fingers and toes, occasional head banging, and rumination (regurgitating and reswallowing food)-- were present when she was admitted to Sunland. There is no clue as to how or why the behaviors emerged.

Shortly thereafter, some formal programming began. Her records state that she was being trained in "self-help skills," but there is no account of the regularity, intensity,

or nature of the training. No skills development was recorded.

During the same period, Claudia was assigned a foster grandparent, Julia. The foster grandparent program provides elderly people a small supplemental income and was designed to give the lowest level clients personal attention and a chance to get outdoors for several hours each day. Although structured training is not necessarily part of the program, a grandparent is often a client's only source of special attention. Julia thus became a major figure in Claudia's life, appearing five days a week to take Claudia out of her cottage in a wheelchair to tour the grounds or sit in the sun.

In 1974, a physical therapist examined Claudia, now 15. She had never learned to walk, nor could she learn: both feet were severely turned down and inward at the ankle. She had learned instead to "scoot," as many clients do; sitting upright, she pulled herself forward with her feet, pushing with her hands. She was admitted to the hospital for corrective surgery. The triple arthrodesis operation was performed without complications, and Claudia returned from the hospital physically capable of walking. But she did not walk. There was no one to teach her.

A year later, in July, 1975, Claudia fractured her left tibia. She was placed in the hospital, and there she remained for several months so that the fracture could heal. During her stay in the hospital, her rumination drastically increased. When she returned to Lilac Cottage in November, she weighed forty-nine pounds, down from her previous high of seventy-three.

This was Claudia as 1975 drew to a close. She was seventeen, fifty-six inches tall and weighed forty-nine pounds. Unable to walk, talk, or in any way care for herself, she had developed no new behaviors during her fifteen and a half years at Sunland, except, of course, chewing her fingers and toes, banging her head, and ruminating; the last was slowly killing her by malnutrition.

The STARS Meet Claudia

The STARS Program at Lilac Cottage

In late 1975, federal funds were released to open a new training program at Sunland. Six of us were hired to create the "behavior modification component" of grant PL 89-313. Our grant specifications were flexible; we were to build a staff of seventeen to work on an individual basis with no more than thirty-five profoundly retarded clients under twenty-two years of age. Training was to occur in the areas of motor, self-care, and social skills; that is, we were to be behavioral jacks-of-all-trades.

Our supervisor selected Lilac Cottage as the training site (Fig. 2). It contained girls' and boys' wings and was reputed to have the campus' highest proportion of appropriately-aged "untrainables"-- multiply handicapped, aggressive, and self-abusive clients who needed individual, intense training that other programs could not provide. Funds to hire the remainder of our staff were temporarily "frozen" and money to open our training building was not yet released; so

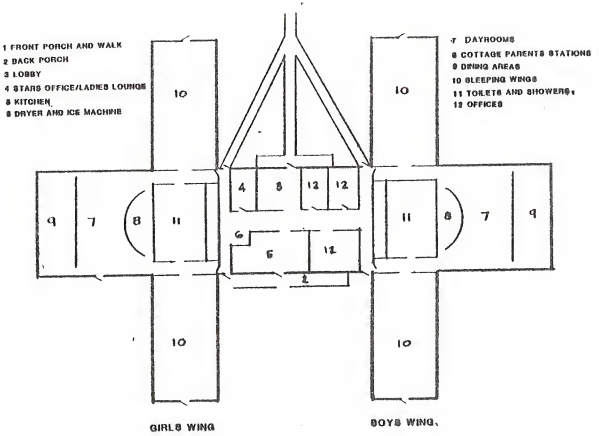


Fig. 2. Lilac Cottage floor plan (not to scale).

a week before Christmas we opened our office in the ladies lounge at Lilac and went to meet our young charges.

Going first to the girls' wing we discovered that the stereotype of institutions was perhaps not just a stereotype. The doors were locked to prevent ambulatory clients from running or wandering away. Within, we found drab concrete-block-and-tile walls and bare floors; no bright colors or decorations or toys relieved the monotony. As much as the physical layout was typically institutional, the clients were even moreso: thirty girls, most of them lying or crawling on the floor, several who were ambulatory wandering aimlessly or coming up to grab at us. All of them were dressed in ragged clothes or ripped gowns. Clothing was for shredding and toys for breaking-- any free object was for mouthing and eating. We had tried to choose a population in need of training. Clearly, we had chosen correctly.

Since there were thirty girls, and twenty-five boys in the other wing, and our enrollment limit was thirty-five, our first task was forming a list of priority clients. Test scores and profiles were of limited value as the clients ranged from low-I.Q. to untestable and most were labeled profoundly retarded. The most obvious way to begin our list was to ask those who best knew the clients-- the cottage parents, or residential care staff, whose job was to bathe, diaper, dress, feed and otherwise care for the clients.

They laughed at our first request. All the children needed anything we could give them. But yes, there was one

girl about whom they were especially concerned. Claudia had been ruminating more than ever, and they were worried about her.

They pointed her out to us. From a distance she was not remarkable, one of the smaller figures in white, laying on her back with knees tucked up about her chest. Walking over and sitting down beside her, we understood the cottage parents' concern. Her knees were huge compared to her toothpick legs, her arms were skinnier still, and her ribs showed clearly through where her gown was ripped. She had shoved about six inches of a diaper into her mouth and periodically made a small gagging noise, following which a milky vomitus appeared in her mouth. Half the substance ran down her chin onto the diaper and gown; she manipulated the remainder with her large tongue, turning it over while chewing on the diaper. After about twenty seconds, she swallowed and repeated the process.

It was difficult to determine whether Claudia was attending to us. Her eyes diverged and we couldn't ascertain where or if she was focusing. In any case, she made no attempt to reach for us and altered neither her position nor her ruminating routine. She evidenced no awareness of our presence.

We examined the remainder of our potential clients and retreated to our office to begin building our program.

Initial Observations

We six were young, fresh, eager-- and naive-- and in no mood to await a "go" signal from the state. We had no budget, nor could we hire trainers, but we could prepare our record-keeping systems, programming procedures, and the like. And we could get to know our kids.

Although there was a campus cafeteria, the residents of Lilac and other locked cottages did not attend. Food was delivered by truck to these cottages. The cottage parents dished it and took it on carts to the living wings. At meal time, we went to the wings and helped feed the clients. We discovered which clients possessed which skills, learned to diaper them, played with them, and wondered about the job we were taking on.

We also knew at least one client with whom we would be working, and obtaining a baseline record of Claudia's rumination became our first official project. Designing the data collection and recording procedures became my responsibility.

My first activity was to observe Claudia's feeding procedure and get a closer look at her rumination. The feeding routine rarely varied. Claudia's diet consisted entirely of "blend," or pureed vegetables, meat, etc., and Sustacal. Blend was given to clients who didn't chew, and the Sustacal, a nutrient-rich milkshake-like liquid, was prescribed for Claudia to combat her rumination-induced weight loss. When the food cart arrived at the wing, a cottage parent would feed Claudia in whatever position she

was to be found, usually on her back on the floor. The blend was served in twelve ounce bowls and the cottage parents fed it to her in a tablespoon as fast as she could swallow it, about one swallow every five seconds. Following the blend, the cottage parent sat her up and fed her a cup of Sustacal, which she eagerly accepted. Although she wrapped her hands around the cup, she needed help in holding it and had to be slowed down-- left to her own devices, she would open her mouth wide and turn the cup upside down, spilling most of the liquid. The entire procedure took less than five minutes. As the cottage parent moved on to feed another child, Claudia commenced ruminating. After watching the procedure for several meals, I began feeding her. I was uncomfortable feeding her at her accustomed rate, but this was my first baseline and I didn't want to disrupt it, and Claudia certainly didn't object.

During these meals, I was happily forced to correct an initial impression. The girl was not entirely unaware of her surroundings. True, most of the time she attended to nothing, but when the food cart arrived, she looked toward the door. Upon spotting the cart, she balled up her hands and rubbed her eyes and nose, making excited gurgling noises. If she was not first to be fed, she scooted over to the cart, looked up at it and continued her noisemaking until it was her turn to eat. If and when we could control the rumination, we obviously had a powerful reinforcer for other training.

I soon discovered that food was not the only thing that commanded Claudia's attention. Monday through Friday, at ten o'clock, the foster grannies arrived. Claudia looked as they entered the cottage, and she was clearly able to discriminate her granny, Julia. The hands balled up and she rubbed her eyes and nose; she watched closely as Julia collected a sweater and wheelchair for the daily outing. Once in the wheelchair and out the door, Claudia calmed down again, ruminating and attending to little around her. But at least we were certain that she enjoyed leaving the cottage and that she could discriminate the source of this pleasure.

Watching Claudia ruminate as she went out with Julia piqued my curiosity. She seemed to enjoy going out, and it was her only break from Lilac, yet the ruminating continued. Before beginning systematic data collection, I couldn't resist playing a little, trying to find an activity that would reduce the rumination. I talked to her and, poor thing, sang to her, sat her up and played with her hands, but without result. I stood her up and walked her around the cottage. She was capable of walking with complete physical assistance, but she ruminated as well standing as she did on her back. The cottage parents said she liked balls but had no chance to play with them as they were among the other clients' favorite objects to tear and eat. I produced a ball and she became excited, bouncing it and even attempting to keep other clients from grabbing it. Here was yet another potential reinforcer and further evidence of intelligence and motor

control, but still no help for the problem at hand. Ruminating and bouncing the ball were not at all incompatible.

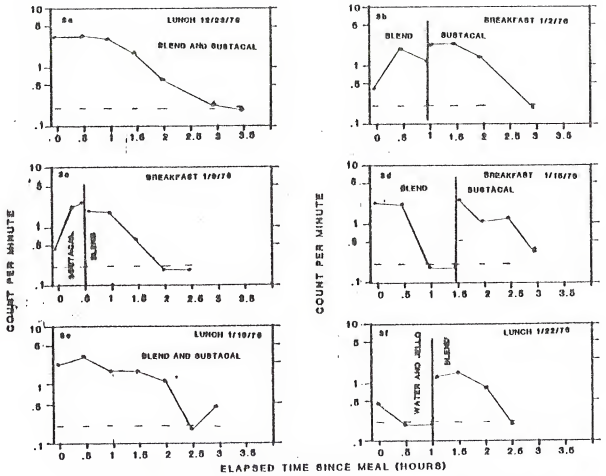
So much for clever ideas. It was time to quantify the problem and explore it carefully. But we had learned much from these first encounters. Claudia responded to things and people around her. Perhaps eventually we could do more than try to stop the rumination.

Rumination Baseline

We were in a hurry and wanted to do everything at once. We had arrived at Lilac two days earlier and were simultaneously trying to get acquainted with our clients, develop assessments, set office policies, and wrest our grant money and training positions from the state. Now Claudia had caught our attention. We needed to collect the data necessary to make our first training decisions without disrupting our grant start-up activities.

As we had neither staff nor time to continuously monitor Claudia, we chose a sampling scheme. At breakfast and lunch one of us fed her in the usual manner. Immediately after the meal, the staff member stood back and counted the ruminations for five minutes. A staffer returned for five minutes each half hour thereafter until no ruminations were observed in two successive samples. The ruminations were easy to count, as the gagging noise was clear, the vomitus easily visible, and chewing was pronounced following each response.

The rumination followed a regular pattern (Figure 3a). Immediately after eating, Claudia ruminated about three times



Figs. 3a-3f. Records of rumination showing the effects of simple interventions in the timing and nature of foodstuffs presented.

per minute and did so for about an hour. Thereafter, the frequency gradually decreased, tapering off to near-zero three to four hours after the meal.

We knew that actual training could not begin until well after Christmas. We had yet to hire our staff and once hired, they had to endure two weeks of orientation and inservice work. We also knew that Claudia was a heavy ruminator-- her physical condition well attested to it-- and we could see no sense in belaboring the obvious by collecting weeks of "uncontaminated" baseline. We couldn't train Claudia but we could manipulate her diet and observe the effects on rumination frequency.

The Sustacal was a likely place to start. Although the doctors had prescribed it to keep her alive, we were struck by the similar appearance and viscosity of the nutriment and the ruminative vomitus. In the ensuing weeks we fed Claudia her blend and Sustacal separately; blend an hour before Sustacal (Figure 3b), Sustacal a half hour before blend (Figure 3c), and no Sustacal until food-induced ruminating had ceased (Figure 3d). We returned to the original baseline condition and took stock (Figure 3e). Although the data were not convincing, Sustacal seemed to induce more rumination than did the blend.

We called the rounds nurse and obtained permission to replace the Sustacal with water and jello for several days. We were encouraged by the result (Figure 3f). Ruminating after blend continued, but the water and jello, given an

hour previously, induced little rumination. Fearing the consequences of removing the extra nourishment from Claudia's diet, we returned to our original baseline condition and began planning training procedures. We had never succeeded in decreasing the overall rumination frequency below one per two minutes (Figure 4), but we had demonstrated to ourselves that we could induce behavior change in our clients. It was a heartening fact to those of us new to the field.

Designing the Rumination Procedure

While we were manipulating Claudia's diet, the state released our training positions. We hired our staff and arranged our schedule. Since decreasing self-abusive behaviors was to be a training priority, we devised staggered shifts covering twelve hours per day, seven days per week. In this way, clients chosen for intensive training could be monitored during most of their waking hours, including all meal times, and there would be no need to base training decisions upon small behavioral samples. Claudia and Tammy, a girl who had pulled out most of her hair and slapped her face severely, were to be the clients to receive twelve-hour-daily training.

As we awaited our trainers' return from their orientation activities, we assessed the results of Claudia's baseline and considered possible procedures for decreasing the rumination. We wanted first to restructure the mealtime environment. Even though Claudia had demonstrated that she would ruminate

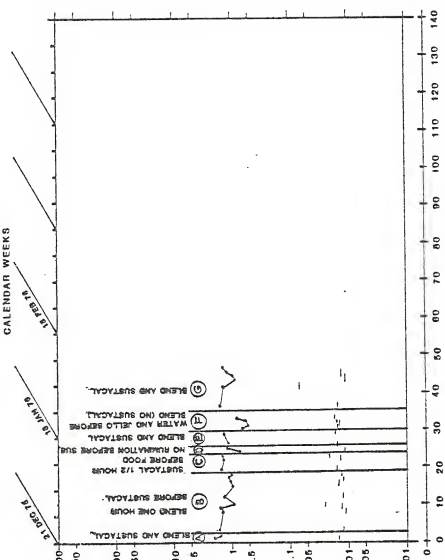


Fig. 4. Rumination during dietary manipulation.

wherever she found herself, we thought that a more closely controlled setting than the floor of the cottage day room would foster more effective intervention. Our program owned several pieces of equipment purchased with early grant funds. One of the purchases was a small wooden relaxation chair commonly used by physical therapists. It was perfectly suited to our needs. The adjustable head rest and clip-on tray would allow us to feed Claudia in an upright position and would restrict her movements without discomfort. We could watch her closely for post-meal rumination. The apparatus was mounted on wheels, giving us the option of feeding her in the bedroom area or hall, away from her usual location without having to drag her into and out of a wheelchair.

We also agreed that it would be wise to slow down her eating. Most of the clients ate rapidly, whether feeding themselves or fed by the cottage parents; the fast eating did not seem to induce rumination. Still, Claudia did not ruminate while she ate and perhaps increasing the duration of the meal and decreasing the rate of food intake might help slow the rumination. We watched one another in the campus cafeteria and concluded that one bite per fifteen seconds was a reasonable rate.

The Sustacal posed a tricky problem. Our data suggested that Claudia ruminated less without it, yet it constituted a major portion of her nourishment and possibly was keeping her alive. While we pondered the medical and financial

feasibility of various powdered food additives, one of the cottage parents offered a far simpler solution. Why not mash peanut butter and jelly sandwiches into the blend? The result might not be esthetically pleasing, but neither was the blend alone, and Claudia was hardly a gourmet. The peanut butter was rich in protein, the whole sandwich might put weight on her, and the thick, gooey product certainly looked harder to ruminate than did Sustacal. The rounds nurse readily granted approval. We could eliminate the Sustacal, replacing it with our concoction. Water and jello before the meal would ensure adequate liquid intake. We would be alerted to any problems arising from the new diet, as we had been weighing Claudia almost daily since data collection had begun.

We were not satisfied. Our planned procedure would probably reduce the rumination but almost certainly not stop it. We could foresee a temporary decrease in the rumination frequency, followed by a gradual increase as Claudia adjusted to her new diet and feeding environment. Any other training we might try would be hampered by and possibly enhance the rumination. We therefore sought assistance from published cases of rumination treatment.

We located two strategies, response-contingent electric shock (Lang & Melamed, 1969) and response-contingent squirts of lemon juice (Sajwaj, Libet, and Agras, 1974). Shock was out of the question. No one had ever systematically tried to stop Claudia's rumination, and to begin with such a painful procedure would be irresponsible and unfair to Claudia. In

addition, Florida's retardation system operated under a set of behavior management guidelines that clearly forbade the use of shock.

Using lemon juice was feasible. A trainer could use a laboratory wash bottle to squirt a small amount, one cc or less, onto Claudia's tongue each time she attempted to ruminate. The attempts were easy to spot. The gagging noise reliably preceded each appearance of the vomitus and we could thus "catch her in the act," increasing the likelihood of our success.

Our final preparatory step was to present our baseline data and planned procedures to the campus behavior management committee. At the time, even using lemon juice was of questionable status in the behavior management guidelines and required the approval of campus administrators and consulting professionals. Moreover, behavior modification was a newcomer to the campus and its practitioners were closely monitored. Permission was granted and we were ready to begin.

Several years later, a colleague asked me why-- after I had independently assessed at least several elements of our procedures during those first weeks-- I chose a "kitchen sink" treatment. The relaxation chair, the spaced feeding, the diet changes, the lemon juice, all at once; it was hardly a systematic approach to the problem. Granted, it was not. But it was our program's first project and we were testing our competency as behavior change agents. For the Sunland campus, it was a test of a new kind of training,

intense, individualized, and based directly upon behavioral data. Most importantly, it was our chance to help Claudia. She did not know us; we had done little except observe her rumination. But we were getting to know her and wanted to help. We planned to use every tool at our disposal to do so.

Training Begins

Results of the Rumination Procedure

On February 5th, Claudia ate her breakfast as she usually did, on the day room floor. She spent the morning ruminating while Marsha-- the trainer I assigned to Claudia-- and I passed the time fretting, pacing and reviewing procedural details. At lunch time, Marsha brought in the relaxation chair. We seated Claudia and wheeled her into the bedroom area. Marsha placed herself opposite Claudia and arranged response counters, stop watch, the gooey mess that was lunch, and the wash bottle of lemon juice. The feeding went smoothly and we even observed an extra benefit. The sticky peanut butter, harder to swallow than blend, helped pace the food intake. Claudia was hardly fazed by our tension and the new setting and diet. Soon after lunch we heard the first gag. Marsha was ready and delivered the lemon juice accompanied by a stern, "No, Claudia!" The intervention startled Claudia and she jerked her head away. She ruminated again, and again Marsha was ready. The attempts to ruminate dropped abruptly and within an hour we were able to take her out of the relaxation chair. We seated her in the cottage

lobby to watch her and be ready with the lemon juice until we were sure ruminating had ceased for the afternoon.

At dinner we repeated the procedure and were again successful. Claudia had begun the day ruminating at her usual rate of one to two per minute. With our procedure in place, the rate dropped to about one in seven minutes, an eightfold decrease. We went home that night elated but concerned. Would the effect last or was it merely due to the novelty of the procedural barrage?

The next day indicated that it was not. The ruminating rate remained low. After breakfast, trainer and lemon juice accompanied Claudia and Julia on their daily excursion. Julia had watched Claudia vomiting herself to death and had helped us during baseline data collection. She and the other foster grandparents shared our excitement.

On the third day, the ruminating rate declined to one in twenty minutes; by the fourth day it was one in fifty. Within a week, Claudia had gained five pounds and was ruminating at one one-hundredth her original rate. The rate stabilized (Figures 5, 6a). Within two months we were able to give her her liquid after meals, with no increase in rumination.

With the rumination under control, Susan, Claudia's morning trainer, decided to find out what Claudia liked to eat. We had purchased a variety of candy and snacks for the clients and Claudia was entitled to her share. I arrived at work one morning to find Susan upset. If Claudia had to put up with the unsightly blend because she couldn't chew, why was

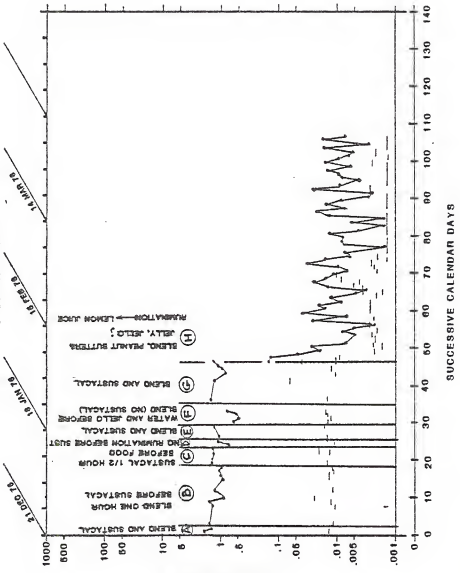


Fig. 5. Rumination through early April, 1976 (first intervention phase).

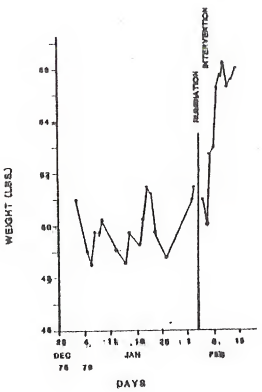
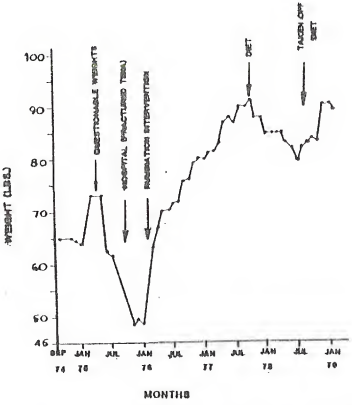


Fig. 6a. Daily weight prior to and immediately following introduction of rumination intervention procedure.



Figs. 6b. Monthly summary of weight. Data points represent weight taken on or about the 15th of each month.

she so adept at crunching potato chips? I didn't know. Neither did the medical staff, so we replaced the blend with regular meals, still supplemented by peanut butter and jelly.

Claudia continued to gain weight (Figure 6b). During the next several months, we eliminated the peanut butter and jelly sandwiches one meal at a time. Much later, we had to put her on a diet and remove fattening desserts. We looked back at the early weight records and laughed.

Building New Behaviors I: Eye Contact

In our concern over her rumination, we had given little thought to what we might teach Claudia. Several days had passed since we had begun rumination intervention and her trainers now had little to do but watch her. We did not dare return her unattended to the cottage day room for fear the rumination would regain its previous rate. Claudia possessed a limited behavioral repertoire and by reducing the rumination we had left her with almost nothing. Where to start building?

"Attention span" was a logical prerequisite for training. Eye contact with the trainer was widely regarded as the first step in establishing visual attending behavior (Kozloff, 1973; Foxx, 1977). In addition, it seemed that recognizing one's name was a necessary, basic skill, one that Claudia did not possess. We had never seen her respond to her name or to anyone's voice. Only loud noises and the sound of the cottage door and rolling food cart seemed to attract her attention.

We resolved to teach her to look at us when we called her name.

To ascertain that she did not, in fact, know her name, we began with a baseline procedure while she sat in her relaxation chair before meals. When Marsha was sure that Claudia was not looking at her, she would say, "Claudia, look at me" and record whether Claudia's eyes met her own within five seconds. Marsha continued in this manner for five weeks, about two minutes per session, and obtained relative frequencies of looking and not looking. During the first three weeks, Claudia rarely responded. Over the next two weeks, she began to make eye contact more frequently, but during only one session did she respond appropriately more often than not (Figure 7, phase A).

We reasoned that if we continued in this way, Claudia might eventually learn to respond consistently to Marsha's voice. However, we wished to teach her more rapidly. We required Claudia to earn part of her meal by making eye contact. The procedure was similar to the previous one, except that it occurred during the first part of the meal. Marsha timed and counted the eye contacts, giving Claudia a spoonful of food on a continuous (CRF) schedule, one spoonful for each success. After Claudia had earned twenty spoonfuls, Marsha fed her the remainder of the meal. We had observed previously that Claudia's eyes invariably followed the spoon during feeding. We used this finding to institute a "fading" procedure (e.g., Whaley & Malott, 1968; Bassinger et al., 1971): Marsha began the training with the spoon

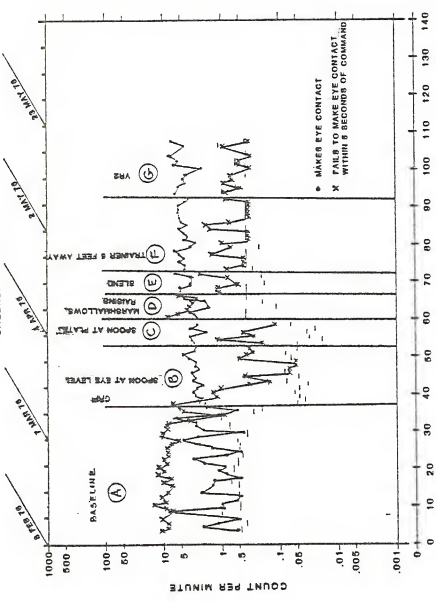


Fig. 7. Eye contact/failure to make eye contact within 5 sec. of trainer's command, "Claudia, look at me."

directly in front of her eyes and over the next two and a half weeks gradually lowered it to plate level ("faded out" the spoon) while maintaining eye contact (Figure 7, phases B, C). After four and a half weeks the behavior was stable, but how long it had taken to teach such a simple response! Hank, my graduate advisor, was visiting one afternoon when Claudia was missing more responses than usual. I told him that I knew retardation training would be slow and painstaking, but until now I hadn't understood the definition of "slow." It was only the beginning.

We had achieved some measure of control over the eye contact at mealtimes, and extending this skill to other situations seemed imperative. We must continue to use food to reinforce the behavior, that much was clear, but extra feeding between meals might increase the rumination. We opted for small bits of food, marshmallows and raisins, and conducted the session about an hour before meals. The effect was immediate. We lost our hard-won gains (Figure 7, phase D). Was it the change in session time, or was it the marshmallows and raisins? When she discovered Claudia could chew, Susan had observed that Claudia would eat almost anything but was more excited by her meals than by the snacks. We replaced the marshmallows and raisins with small spoonfuls of blend and regained control of the eye contact (Figure 7, phase E). We had lost control of the eye contact for a week, but our data were instructive: Candy has been widely used as a reinforcer, but our chart indicated that it would not

reinforce Claudia's behavior. It was nice to know that she preferred nutritious substances to junk food, a finding that maintained throughout her training.

We varied position and distance of the trainer relative to Claudia, and began rewarding the eye contact with blend on a variable ratio (VR) 2 schedule, about one spoonful for each two appropriate responses (Figure 7, phases F, G). At the end of the project, Claudia always raised her eyes when we asked her to look at us.

But we had failed in several respects. First, we did not teach "eye contact" with emphasis upon "contact." It was clear that Claudia was not looking at us. Rather, she had developed a cute, stereotyped response, eyes raised to about the level of our eyes, gaze fixed, mouth slightly open to receive the food, head cocked to one side. The fixed gaze, sometimes a shade above or below our eyes, let us know that she was not really looking at us. Second, she had not learned her name, nor did she respond to our voices except in a training situation, with spoon present. We could have continued the project, gradually increasing the ratio of responses to food, but to what avail? We couldn't modify the stereotyped responses.

We gained much from this project, though. We had built a behavior, even if not exactly the one we had intended, where there was none before. Claudia could learn new skills. We also learned that "attention," or at least attention as we viewed it, was not a necessary first step in training. Her

progress in other areas without it would subsequently confirm that fact. She did begin to respond to her name and to really look at us, much later, as a by-product of the thousands of hours we worked with her. The "basic skills" turned out to be complex achievements.

Claudia has never lost this first response she learned. Over the following two years the response would appear again, when we were trying to teach her new skills and having trouble. She would frequently raise her eyes and assume her old expression, as if following the rule, "when all else fails, try eye contact." That facial expression became dear to us.

Building New Behaviors II: Playing Catch

After meals, Claudia's trainers generally gave her a soccer or large plastic ball to bounce while they monitored the rumination. She entertained herself this way for hours. When her trainer brought out the ball immediately after the meal, she grew excited. If the trainer bounced the ball before giving it to her, she frequently bounced in her seat while watching. But once she was given the ball, she rarely returned it.

We saw here an opportunity to interact with Claudia in a purely social manner. Teaching her to play catch might also give her a skill she could use on the cottage with other clients. And it was our first opportunity to play with this girl who knew us only because we fed her and scolded her when she ruminated.

Her trainers tossed her the ball from about four feet away, clapping their hands and telling her to throw it. If she threw or bounced it back, the trainers counted a correct response. If she threw the ball in the wrong direction or failed to throw it at all within ten seconds, the trainer retrieved it and tried again, counting an inappropriate response. When we started, she returned the ball to us about half the time. In only four weeks, we all but eliminated the correct responses (Figure 8, phase A). Most of the time she threw it in the wrong direction, frequently over her shoulder. Perhaps she was responding to terminate the game or to watch us chase the ball. Either way, this was not our idea of a good time.

We reviewed the situation and made note of the following: First, we were sure that playing with the ball was a reinforcer. Before we had begun the catch program, Claudia reliably grew excited upon presentation of the ball and quickly retrieved it if it rolled away from her. She played with it for seemingly endless periods of time; this was a high-rate behavior and therefore a potential reinforcer (Premack, 1965). Second, we recalled the well-established findings that satiation decreases the effectiveness of reinforcers and deprivation increases reinforcers' effectiveness. Prior to our interaction with Claudia, she rarely had access to balls; she now had access to them for several hours per day in addition to the catch-program time. We might well be observing the effect of satiation. If so, we would do well

to create instead a state of deprivation by limiting her access to the ball. Finally, we analyzed the consequences we had arranged for the game of catch. When Claudia responded correctly by throwing the ball to us, we threw it back, continuing her access to the reinforcer. However, inappropriate throws resulted in almost the same consequence-- we retrieved the ball and threw it to her again. A widely-used, highly successful method of reducing inappropriate behavior is "timeout," the brief withdrawal of a reinforcer contingent upon the undesired response. Perhaps such an arrangement-- briefly limiting access to the ball after incorrect throws-- would be an effective consequence.

Based on our analysis, we changed the rules of the game so that she would play our way or not at all. We only gave her access to the ball during sessions. If she threw it in the wrong direction we stopped the game for two minutes (the stopwatch did not run during this time). If she threw it in the wrong direction twice in succession, we terminated the game and did not play again until after her next meal.

It was hard to enforce the new rules. We were growing fond of Claudia and playing with the ball was the only thing, except eating and going out with Julia, she liked to do. We did not like to take away the ball, but we were determined to teach her to play with others. Most of her fellow clients seemed to enjoy our attention, and we were spending more time with Claudia. Besides, we didn't enjoy chasing the ball around the cottage.

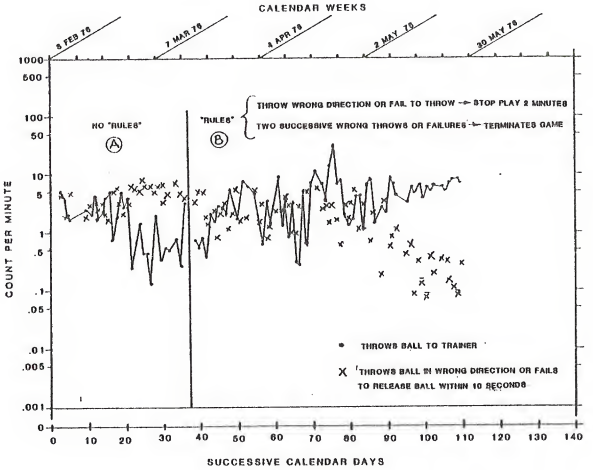


Fig. 8. Ball-throwing. Record floors are omitted except to indicate freq. = 0, and X's are not connected for printed clarity. Average session duration = 5 min.

We hung on and slowly, imperceptibly, she began to play (Figure 8, phase B). After eleven weeks, we terminated the procedure, or rather she terminated it. She would throw the ball as long as anyone was willing to play with her and she wore out trainer after trainer. We gave her free access to the ball again and the choice was hers. If she wanted to play, we'd play, but we were grateful for the rest when she bounced the ball by herself.

Trainers who have resigned return to visit the program and usually play catch with Claudia. It's easy to buy her a present she will appreciate, and she owns a truly impressive assortment of balls.

By-Products of the Early Training

Claudia's success in her new programs bolstered our confidence. We had begun the eye contact and ball-toss sessions simultaneously, within a week after starting the rumination intervention. The rumination rate remained low while Claudia acquired her new skills. Most of our staff worked with Claudia at one time or another, and we were all excited and proud.

But in early spring, the staff had some bad news for Marsha, Georgianne, and me, the people responsible for her training. "Your baby," they told us, "is spoiled rotten." We couldn't deny it. Before training began, Claudia had lain passively on the day room floor, growing excited only when Julia or the food cart arrived. Now there were occasional tantrums if her trainer arrived late for her meals. She would

cry and rock forward, sometimes banging her head on the floor. We were not worried about these tantrums, they seldom happened and the head banging occurred only rarely. Usually, she merely rocked, her forehead stopping inches from the floor. Occasionally she hit it and looked at us, commencing to cry. At least she knows us, we thought. The tantrums did not become a problem. We generally arrived before the food, and if a tantrum was in progress we did not begin her session until she was quiet.

A more pressing problem was after-meal tantrums. We were still keeping her in the relaxation chair for a brief period following each meal, the crucial time for rumination. We were reducing this chair time, but evidently not fast enough for Claudia. She began screaming and crying, jerking around in the chair. We did not want to take her out once she started crying and risk teaching her to misbehave. Neither could we use an "extinction" method, that is, simply ignore Claudia until the tantrum ceased. Her behavior was more violent in the chair than during premeal tantrums and we were afraid that if we ignored her, she'd hurt herself while destroying the chair.

We simply could not let the tantrums begin. I took advantage of the chair's mobility, rolling it up and down the hall soon after she finished her meal. I could keep a close eye on her in case of rumination and she seemed to enjoy the ride; she gave me one of her rare smiles. I pulled a little faster, she smiled more. The weather was turning

pleasant, so I rolled her out of the cottage and we went tearing up and down the sidewalk. She laughed long and hard, and won our hearts.

Basic Self-Feeding Skills

By early April we had a name for our program, STARS (for Start Training Appropriate Responses to Stimuli), a new training building, and a budget. It was spring and a time for change.

Marsha, George, and I grew more ambitious with Claudia's training. She had shown herself capable of at least simple skills, given time, patience, and careful monitoring by those who worked with her. Virtually everything had to be done for her and we wished to help her acquire more independence. The two areas that appeared to offer the best beginning were feeding and ambulation. Although her movements were jerky, Claudia was not spastic, so independent feeding did not seem an unreasonable goal. The triple arthrodesis operation several years earlier had left her physically capable of walking. We tackled both problems at once.

Learning to Scoop

Teaching Claudia to feed herself was perhaps the most initially promising and eventually frustrating project we attempted. She acquired the basic skill, independent scooping, more rapidly than anything else we taught her. Polishing the basic behavior and adding related skills was

an incredibly slow process and we met with failure more than once.

We began, of course, in the relaxation chair at mealtime. The chair was as ideal for teaching feeding as it was for monitoring the rumination. She sat straight and the clip-on tray was at a comfortable height. As much as she loved to eat, we knew she would be highly motivated to learn this new skill.

She had no trouble holding a teaspoon loosely in her fist, but we were unable to induce her to hold it as one usually does, between the index and third fingers with thumb on top. However, we had observed many clients feeding themselves using a fist-grip. It was more awkward than a normal grip but it seemed to get the job done. We considered ourselves to be lucky that Claudia held the spoon at all without prior training and we accepted the fist-grip. Her grasp was not strong, however; so we began the program with a built-up spoon, a commercially available product that has been successfully used to teach feeding skills to the profoundly retarded (Miller, Patton, and Henton, 1971). The handle of the spoon was a plastic cylinder three-quarters inch in diameter. This Claudia held firmly enough.

The procedure was simple. For the first few trials, Marsha wrapped her hand around Claudia's and guided her through the entire motion, lowering the spoon, loading it with food, and raising it to her mouth. Marsha felt little resistance from Claudia's arm; the movement was smooth and

natural. Marsha next released her hand and Claudia, with some difficulty, successfully loaded the spoon and fed herself. Claudia was awkward but persistent and Marsha did not intervene on a given scoop until it became clear that Claudia would not succeed on her own. When such was the case, Marsha took Claudia's hand and finished the scoop with her. Claudia was free to try alone on the next scoop. The first day, Claudia scooped without assistance in one of every four attempts. In little more than a week she was scooping entirely independently. We allowed her to continue in this manner for several more weeks to gain proficiency. On the first day of training she had scooped independently at the rate of once per two minutes. Her speed rapidly increased to about eight scoops per minute (Figure 9, phase A).

Once again, Claudia had come through for us. For seventeen and a half years she had been fed and within a few weeks was able to scoop on her own. It was so easy. We planned to put on the finishing touches, to teach her to use a regular spoon and to eat more neatly so that we could remove her bib. We were to be surprised and disappointed.

Fine Details of Scooping

Although she was scooping rapidly and without assistance, Claudia was making a mess. She had added a new component to the scooping movement, rolling her wrist as she lifted the spoon to her mouth, taking it in upside down. Much of her diet was soft and sticky and adhered to the spoon, but the remainder landed on her bib, the tray, and the floor.

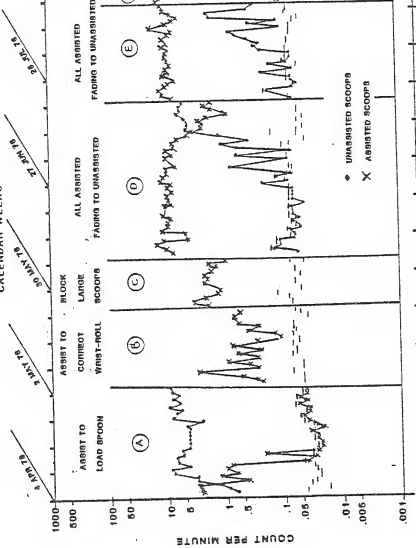


Fig. 9. Scooping with a spoon. Chart is continued for next three pages.

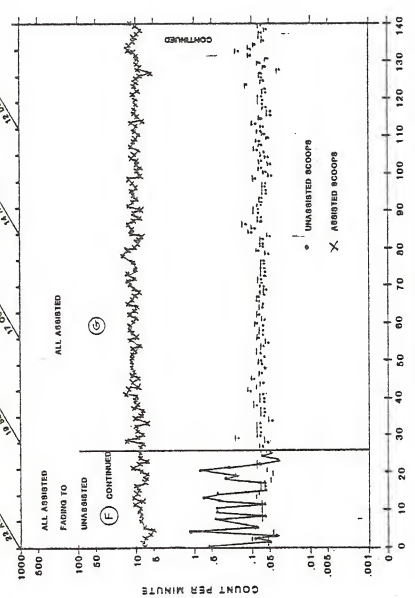
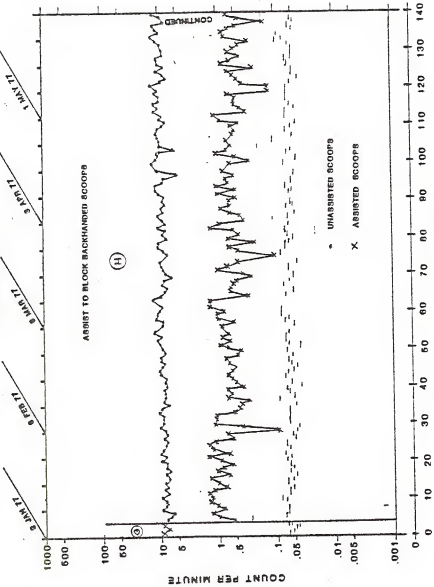


Fig. 9, continued.



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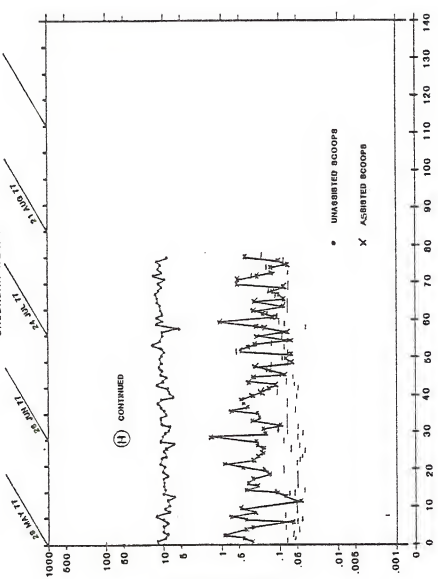

Fig. 9, continued.

We had not intervened as the behavior developed since we did not wish to interfere with her independent scoops.

We concentrated on the wrist rolling. Her grasp was firmer now, and we replaced the built-up spoon with a regular teaspoon, the handle of which we covered with friction tape to prevent slipping. We temporarily discontinued monitoring the unassisted scoops and began assisting her again, correcting position of spoon and wrist. We were not successful; we were unable to decrease the frequency of assistance (Figure 9, phase B). We also had to intervene in other ways. She was taking larger and larger spoonfuls. At one point, she lifted her entire portion of mashed potatoes and attempted to get them all in her mouth. She was as likely to scoop the food from her bib or the tray as she was from the plate. We began blocking the large and off-plate scoops, each block accompanied by an assist to initiate a correct scoop. We were unsuccessful again (phase C). At least, we consoled one another, she never attempted to use her fingers, even when struggling to scoop a small morsel from the corner of the plate.

We decided to begin afresh, to build a new scooping movement. For several weeks we held her wrist on every scoop, guiding her entirely through the motion. Then we gradually allowed her to scoop independently, increasing the frequency of unassisted scoops until they accounted for 75% of the total (phase D).

The frequency of large scoops was decreased and the wrist-rolling was gone. Gone also was the tape on the spoon, worn off by repeated washing. Her grip was solid so we did not replace the tape. But now there was a new problem. She had begun scooping backhanded, shoving most of the food off the rear edge of the plate. We repeated our strategy, beginning with complete assistance and then allowing increasing numbers of independent scoops (phase E). Before she had even achieved one independent scoop per minute, her backhand returned. Again we assisted her entirely, then relaxed the assistance, and again she back-scooped (phase F).

We did not know what else to do. We considered several strategies and rejected them. Many more ideas, of course, present themselves in hindsight. But we coped with the problem in our usual manner. We returned to complete physical assistance, this time for several months (Figure 9, phase G).

Many changes occurred during this period. Claudia began eating at the campus cafeteria as a result of her progress in other training sessions. The change in scenery did not help; occasional probes revealed that the backhanded scooping would reappear if given the chance. None of us could think of a way to modify the behavior.

In January, 1977, more out of frustration and discouragement than out of any change we observed in Claudia's behavior, we changed the procedure. We allowed her to scoop independently, blocking and re-directing any attempted backhand scoops. She immediately regained her original independent

scooping rate of eight per minute. We had to assist her just over once per minute and elected to wait and see what happened (Figure 9, phase H). Over the next seven months, the rate of assistance decreased to about once in five minutes, or several assists per meal.

We had, I suppose, succeeded. But the behavior change was small in relation to our expectations. We nevertheless continued to work on her feeding skills, meeting with success in some attempts and failure in others. Had Claudia not shown such remarkable progress in other areas, we would have been thoroughly discouraged.

Learning to Walk

While Claudia's progress in her feeding programs was slow and often discouraging, helping her acquire ambulation skills rewarded us often. Progress was rapid at times and slow at others. The training frequently bogged down and was then revitalized by a sudden breakthrough. We had to face limits in some areas while in others she continued to grow. Teaching her to walk provided both the most challenging and gratifying experiences we had with her.

We had been considering teaching Claudia to walk from the time we began working with her rumination. She had undergone the operation to repair her feet, giving her the physical capability to walk. Examining the conditions under which she ruminated, I had discovered that she would walk short distances if I held her hand tightly. However, the

rumination caused us to delay the start of formal walking. We wanted first to bring the rumination under control and effect a weight gain, as we were afraid that her pathetic legs could not withstand any strain. While we waited, we began several preliminary programs to assess her current capabilities and to exercise her legs.

Preparatory Programs

The day after rumination intervention began, we started walking Claudia for a minute or two at a time, several times per day. Her trainers held her hands tightly but made no effort to force her to walk. She walked at a rate of fifty to eighty steps per minute, sitting down every fifteen to twenty seconds. Her steps were small, each covering about eight inches. They were not uncertain, clearly steps and not shuffles, but they were jerky and she swayed from side to side. This peculiar gait may have been due to the fact that she never developed hip rotation. The swaying motion, while greatly reduced, has never disappeared and one can always spot Claudia walking, even at a distance.

For additional exercise we had her push an empty wheelchair. Her trainers walked behind her, keeping her hands firmly on the grips. She walked slightly faster with the wheelchair, between ninety and one hundred steps per minute. However, we abandoned the program within two weeks as keeping her hands on the chair was a problem and the trainers had trouble positioning themselves, leaning over her to maintain contact with her hands.

Walking provided only several minutes of exercise each day and we did not feel that this was adequate. Although it was winter, it was frequently warm enough to go out during the afternoon, so we tried our luck with a tricycle. A trike would exercise her legs for about ten minutes at a time without straining her. Not her, perhaps, but it certainly strained us. Claudia would not keep her feet on the pedals. We tried built-up pedals, straps, and pedal stirrups, but with a wiggle or two of her feet she undid our best efforts. Several shoe laces tied end to end finally served the purpose. Enough loops and knots and twists and turns, and her feet remained firmly planted on the pedals. At first it took two of us, one to balance her on the seat and one to perform the elaborate tying-on ritual. When she became accustomed to the trike, she helped by sitting still and only one trainer was necessary.

With her obviously limited tricycling experience, we were not surprised to find that Claudia did not pedal. For three weeks we pushed her. The rotating pedals stretched and flexed her legs, giving them at least some exercise. In the middle of March, we noticed that we didn't have to push as often-- Claudia was doing some of the work too. We counted assists to move or steer, initially providing assistance almost six times per minute (Figure 10, phase A). Three weeks later, when we began her formal walking programs, we were still assisting her at this rate, but there had been several days during which substantially fewer assists were necessary.

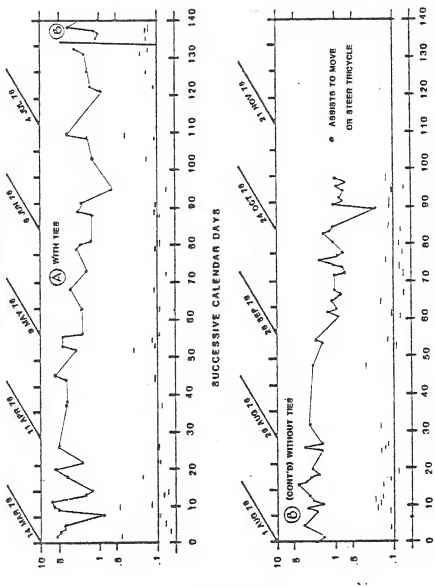

Fig. 10. Tricycle riding.

The tricycle had served its original purpose in that it had given Claudia exercise preparatory to walking. But these first signs of success on the trike encouraged us to continue the program as an added form of recreation. We maintained the program only sporadically, but Claudia slowly improved. At the end of July, we happily dispensed with the shoelaces, and she kept her feet on the pedals (Figure 10, phase B). A year and a half later, Claudia graduated to a bicycle with training wheels. She pedaled with nowhere near the proficiency required to eliminate the training wheels, but we were satisfied. We had set out to give her exercise, and she had learned a new recreational skill in the process.

The First Independent Steps

We began formal walking sessions in early April on the same day we began teaching Claudia to feed herself, and precisely two months after we began rumination intervention. She weighed sixty-six pounds, seventeen pounds more than when we met her, and we had observed no problems during her previous exercise programs. She seemed ready to walk alone.

We took her into the long hall that connects the girls' and boys' wings and let her sit on the floor. I sat beside her and showed her a cup with several sips of fruit juice in it. She became excited as she always did, rubbing her eyes and nose. I stood, walked back about eight feet, and stopped, always keeping the cup in plain view. She watched intently. From behind, Georgianne placed her hands in Claudia's armpits,

lifted Claudia to a standing position, and walked her forward. About four feet in front of me, Georgianne let go. Claudia walked-- more precisely, staggered-- her first independent steps to my arms and her juice. We repeated the procedure and again she walked the last few steps alone. We were jubilant.

Then, caught up in the excitement of the moment, I erred badly. I wanted to see how far she would walk by herself. On the next attempt, I began walking backwards as she approached me, keeping about one and a half feet between us. She followed me for perhaps twenty feet, stopped abruptly, and sat down. I had pushed her too far. The sudden, drastic increase in the number of steps required for a sip of juice had probably extinguished the walking: Claudia had responded appropriately, I had failed to reinforce the behavior, and the walking disappeared. In such situations, merely requiring less work for each reinforcer is usually sufficient to reinstate the behavior (Reynolds, 1968; Krumboltz & Krumboltz, 1972).

We therefore tried again, only this time I had no intention of moving. A few independent steps would have satisfied me. None were forthcoming. As soon as Georgianne started to remove her hands from the armpits Claudia went down. Nine more attempts produced the same result. I was furious with myself. Weeks of preparation and planning, the sight of Claudia walking alone, and I had apparently negated all of it.

This was also more than a little curious. Claudia had taken weeks to learn to make eye contact, and was not at the time even close to reliably throwing her ball back to her trainers. Yet I had pushed the walking just once and it disappeared. How could one who learned so slowly suddenly learn so fast? How could Claudia be so insensitive to some things in her environment and so sensitive to others? And why did her sensitivities seem to work against us? I did not know the answers then, nor do I now.

We did know, however, that the last time she had walked I was holding a cup of juice and was moving away from her. We tried again, but this time I did not hold the cup. We moved Claudia into the kitchen, I showed her the cup, placed it at the edge of a counter, and moved away. Georgianne lifted her as before, walked her toward the counter, and let go. Claudia covered the remaining three feet on her own and (with Georgianne's help) collected her well-deserved juice.

We continued in the kitchen for a week, ten to twenty trials per day. We recorded the number of independent steps per trial and gradually increased the distance we required Claudia to walk by herself (Figure 11, phase A). We ran out of room when she reached eight steps per trial and moved back into the hall. We set up two small tables and substituted spoonfuls of blend for the juice. Georgianne left Claudia sitting at one table and placed the spoon on the other table. She returned to Claudia and helped her up, but it was no longer necessary to start walking with her; Claudia was able

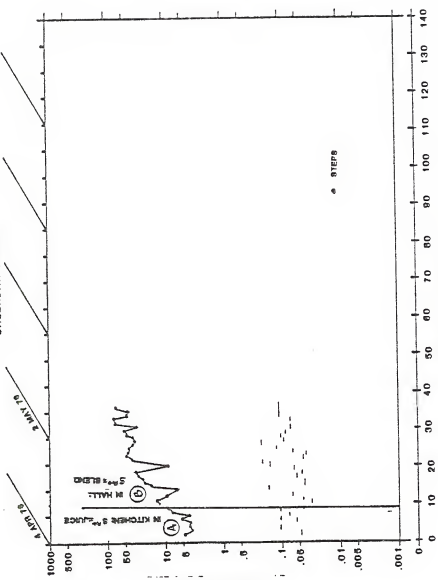

Fig. 11. Unassisted steps. Data are steps per trial; record floors represent number of trials.

to begin each trial from a standing, stationary position. Claudia walked back and forth, receiving the blend and a brief rest at each table. We increased the distance day by day until she traversed the entire hall, seventy of her small steps (Figure 11, phase B).

At each end of the hall was a short passageway leading to the living wing doors. We moved the tables into these passageways, out of Claudia's sight. She was able to turn the corners and find her blend. During these sessions she never stopped and sat down before reaching the goal and her balance, while still not the best, improved.

While we were conducting these formal walking sessions, we also encouraged Claudia's trainers to give her extra, non-food-rewarded practice. The practice consisted of "graduated guidance" (Foxx & Azrin, 1973; Sundel & Sundel, 1975), having Claudia walk with as little assistance as possible. For example, after a meal, Claudia's trainer might walk her from the relaxation chair to the lounge, holding her wrists firmly at first, easing the pressure as she walked, and finally letting go. We counted her attempts to sit down during these short walks and discovered we were having no success (Figure 12). Although she attempted to sit down less frequently than she did before we began training, the rate showed no further decrease as training progressed. We also realized that we were possibly working against ourselves by requiring her to walk without assistance in some situations while helping her in others.

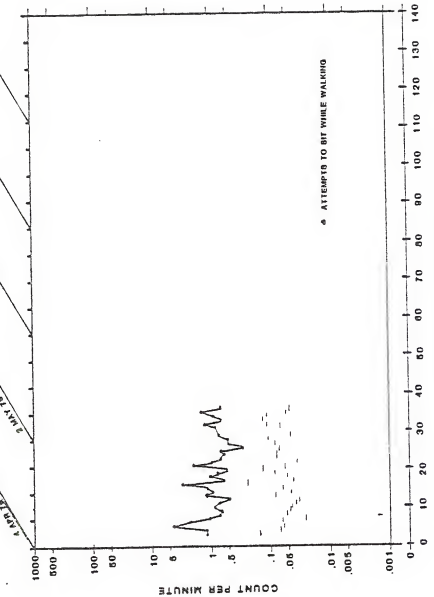

Fig. 12. Attempts to sit while walking.

We abandoned the graduated guidance program and required her to walk short distances in the cottages by herself. When she sat down, which she did frequently, we helped her up but did not assist her in the walking. It was back-breaking work and occasionally took twenty minutes to cover the short distance from lobby to living wing. We didn't mind, for she was walking alone.

Rumination Redux

Unmonitored Rumination

Although we had expanded Claudia's training into many areas, our primary concern remained the rumination. We monitored its frequency constantly as we added new training programs and it did not increase.

We calculated the rate based upon the amount of time Claudia spent with us, initially about ten hours per day. Several months into her training, I became curious to know how she fared when we were not present, from 7:00 p.m. until bedtime, about nine or ten o'clock. The cottage parents told me she was ruminating, though not nearly as often as she had previously. I stayed late one night to find out.

As the other trainers left for the evening, I handed my stopwatch to Betty, one of the cottage parents. I instructed her to start the watch as soon as she heard me close and lock the door, and to turn it off the first time Claudia ruminated. She was then to bang on the plexiglass window in the door, signalling me to return. I left the living wing and had not

yet seated myself in the office when Betty signaled. I returned to the wing and read the stopwatch, seven seconds. I had the washbottle of lemon juice in my pocket but did not remove it. Claudia and I stared at one another for a short time. I did not say or do anything as she did not ruminate again. I reset the watch, gave it back to Betty, and exited. I only walked far enough to be clear of the plexiglass window, knowing that I'd be wasting time to walk further. I was correct; the latency to ruminate was five seconds. This time, I had quite a bit to say to Claudia. It didn't bother me that she couldn't discriminate her own name, let alone the content of my lecture about behavior management skills. It seemed as good a way as any to pass the time and see if she would ruminate in my presence. She did not, of course, and fifteen minutes later, Betty and I tried again. Each of the next three trials registered less than 15 seconds latency.

It is well-known that individuals in programs such as Claudia's-- programs designed to eliminate undesirable behavior-- quickly learn when it is and is not "safe" to emit the target behavior (Lovaas & Simmons, 1969; Rollings, Baumeister, & Baumeister, 1977). Claudia's performance that night indicated that she had learned. I went home to ponder the problems of after-hours rumination.

Several days afterward, I stayed late again to work in the office. It was not hard to avoid the living wing and a rediscovery of Claudia's unmonitored rumination. However, I

did not stop working until after 10:00 p.m. and I couldn't resist looking in to see our kids, so noisy and unmanageable by day, sleeping peacefully. Some clients slept, others were awake but relaxed, and Claudia lay comfortably curled up, ruminating.

I considered the alternatives. We could not extend our training schedule, and Claudia was already receiving more of our time than was any other client. Neither did I want to ask the cottage parents to intervene in the rumination. Two of them were responsible for showering the girls and putting them to bed, and I couldn't expect them to monitor and intervene consistently. In addition, the Florida behavior management guidelines, while unclear on the point, seemed to forbid such intervention by untrained personnel.

I therefore took no action and hoped for the best. The decision eventually proved correct. The nighttime ruminating gradually decreased, as verified by the cottage parents' reports and our periodic monitoring.

Procedural Revision

The first week in April, just before we began Claudia's walking program, I happened upon a fascinating occurrence in the boys' wing. One of the cottage parents was preparing to mop the floor after lunch when a client distracted her. As she tended to the boy, another client spied the open, unguarded closet. He rushed over, reached in, and removed an open bottle of detergent, which he began drinking with gusto. Several of us reached him simultaneously and grabbed the bottle

before he had consumed very much. No harm had been done and he laughed gleefully at our angry gestures and admonishments.

Here was I, convinced that the sour, concentrated lemon juice was controlling Claudia's rumination. The detergent certainly couldn't taste much better, but I had just seen a client consume it with apparent relish. The client was known for his pranks and he invariably laughed at our scoldings; the attention we paid him quite likely overrode the taste of the detergent. Perhaps it was not the lemon juice but some other more powerful aspect of our procedure that controlled the ruminating.

I had a chance to find out the day we began Claudia's walking sessions. Georgianne was struggling with Claudia in the ill-fated assisted walking program. I approached with the wash bottle of lemon juice, held it up, and sweetly offered it to Claudia. The struggling ceased and she continued walking; Georgianne did not let go, however, remembering our experience in the hall earlier that day. When Claudia reached me, I gently squeezed a squirt of the lemon juice into her mouth, caressed her hair, and told her what a good girl she was. She did not flinch or jerk away as she always did when we swooped down on her after a rumination. We sat her down and I induced her to make eye contact repeatedly in return for squirts of lemon juice delivered in this gentle manner.

The results were not surprising. Researchers in the laboratory and in teaching situations have demonstrated that

the events usually used to decrease behavior rates can also--when programmed differently-- serve to reinforce behavior (Kelleher & Morse, 1968; Morse & Kelleher, 1970; Plummer, Baer, & LeBlanc, 1977; Solnick, Rincover, & Peterson, 1977).

In hindsight, I realize that I could have been more thorough. For example, I could have replaced the lemon juice with fruit juice and continued with the wash bottle procedure, observing the effect upon rumination frequency. The simple demonstration with the lemon juice, however, convinced me to alter our intervention strategy. I reasoned that the manner of delivery was the relevant aspect of the procedure, an excited, rapid jab with the wash bottle versus a gentle slow squeeze. The amount and kind of juice were identical but the results markedly different.

We disposed of the wash bottle. With the new training programs it was a nuisance to carry and besides, it leaked. We used our hands instead, holding her cheeks between thumb and third finger, pointing at her tongue with the index finger. We administered this consequence as we had the lemon juice, quickly and sternly.

For several days, the rumination frequency rose slightly but remained well within the range displayed since training began (Figure 13, phase I). It returned thereafter to its usual low level and we continued without the lemon juice.

Reversal and Return to Intervention

By June, there was still no change in the rumination rate, and we thought that we had decreased it as much as possible.

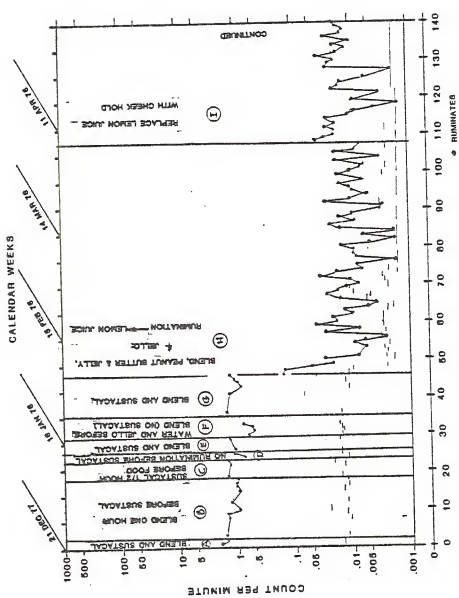

Fig. 13. Rumination through Aug.,1978 (data through Apr., 1976 are same as those presented in Fig. 5). Chart is continued for next three pages.

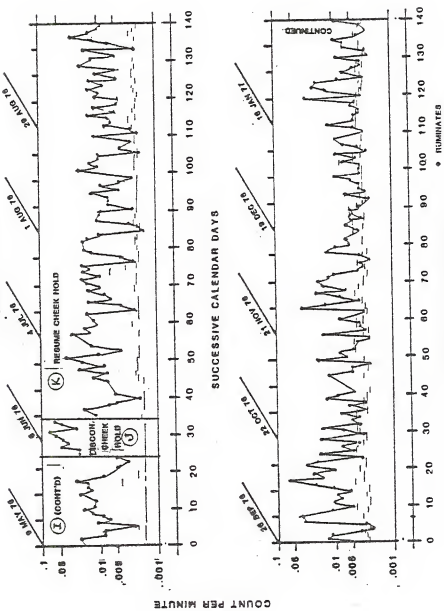

Fig. 13, continued.

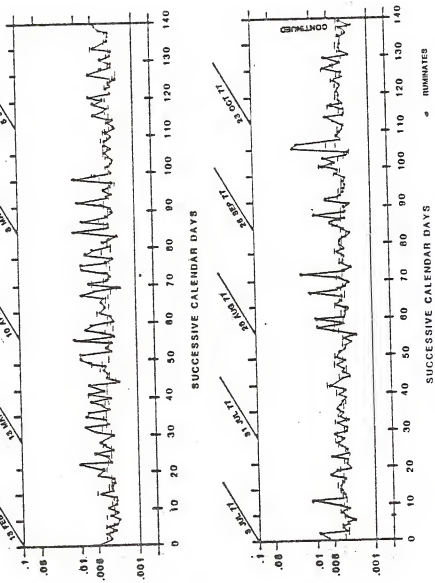

Fig. 13, continued.

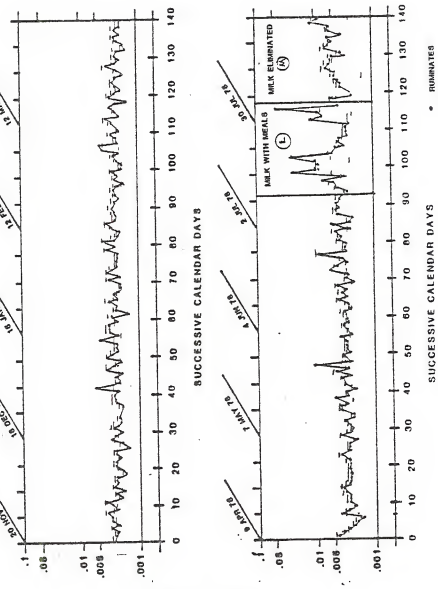

Fig. 13, continued.

It therefore seemed a likely time to abandon the cheek-hold procedure. We agreed to ignore the rumination and continue all other aspects of Claudia's training. Not wishing to inadvertently reinforce the rumination, we planned to discontinue for several minutes any session in progress when a rumination occurred.

The ruminating did not increase during the first two days (Figure 13, phase J). On the third day, however, Claudia averaged one rumination per twenty minutes, a rate equalled or exceeded only in the first two days of the original intervention. In the following week, the rate dropped, climbed, dropped, and climbed again. Overall, it was slightly but noticeably higher than during intervention. We knew that this outcome was likely. We had not decreased the rumination rate to zero and Claudia had therefore immediately contacted the procedural change-- she ruminated without consequence in the presence of her trainers. We were not alarmed, however. Research had shown that response-reduction procedures could be eliminated, then reinstated with no loss in effectiveness (Azrin & Holz, 1966). While we did not worry, neither were we willing to wait. We well remembered Claudia's appearance four months earlier. We reinstituted the cheek-hold procedure and left it permanently in place (phase K).

The rumination frequency gradually declined. In November, 1977, eleven months after we had resumed holding Claudia's cheeks, there were more days during which we saw no rumination than there were days on which rumination occurred. By January, 1978, several weeks would pass between ruminations.

In the summer of 1978, milk was briefly reinstituted in Claudia's diet; it had been removed at the same time as was Sustacal. The rumination frequency rose slightly but perceptibly (phase L); so milk was permanently removed from her diet (phase M).

As the likelihood of rumination decreased, we gradually reduced the amount of Claudia's training time. We were eventually able to safely return her to the cottage living wing within one to one and a half hours after each meal. Whenever we felt she was ready for a decrease in training time, we spent several weeks monitoring her in the living wing. We would return her to the day room and leave, then quietly enter through a side door and station ourselves out of sight. We observed no rumination during these periods.

Although the ruminations were few and far between, we never abandoned the cheek-hold procedure. There was simply no reason to do so. The procedure was all but unused anyway, since there were so few ruminations. However, when a rumination did occur, we felt it best to deliver the consequences to keep the rate as near zero as possible.

When the rumination had almost vanished, hiring new trainers presented a problem. Our original trainers and those hired while Claudia was still ruminating daily understood the importance of the rumination procedure and had many opportunities to observe the response. Trainers hired later, however, operated under a handicap. They rarely saw Claudia ruminate and thus did not know what they were looking for. They also

had difficulty understanding why members of the original staff became upset if a rumination occurred and the consequences were not immediately delivered. How could they understand? They had not known the other Claudia.

In the spring of 1976, we took our clients to a picnic at some lakeside property owned by Sunland. I brought along a camera to record this first of many outings we enjoyed over the next several years. When the pictures were developed we realized that we had not been keeping the most important records of all. These children had changed. Photographic documentation immediately became an integral component of the STARS Program. For some of the clients, like Claudia, the documentation came too late. I recorded on film many of her accomplishments in motor and self-care skills. But missing was the most obvious change of all, that caused by the reduction in rumination.

Our new trainers did not know Claudia as she was before and we had nothing to show them save a blurry snapshot from her cottage records. Our charts precisely documented Claudia's progress but they did not reflect her transformation from a pale, wasted figure on the cottage floor to a healthy girl capable of learning many new things.

Advanced Ambulation Skills

Walking Outdoors

When Claudia was able to walk the length of the cottage hall, we eagerly moved the session outdoors. A long, straight

sidewalk runs from the street to Lilac's front porch. It was ideal for increasing the distance Claudia was required to walk on each trial. The sidewalk is level and was therefore a good place to teach her to walk on surfaces other than smooth tile. There were no bumps and slopes that her poor balance could not accomodate.

We set up two small vinyl chairs not quite thirty feet apart. This was less distance than we required Claudia to walk indoors but seemed adequate in view of the radical change in environment. We used a procedure similar to that employed for indoor walking. We sat Claudia in one chair and put a spoonful of blend or her regular meal in the opposite chair, helped her to a standing position, and let her go. When she arrived at the other chair we simultaneously gave her the food and helped her sit down. After a brief rest, she returned to the first chair in the same manner. She made ten to fifteen one-way trips prior to each meal.

Claudia performed well for the first three days, then caught a twenty-four hour virus. When she regained her health, there was trouble. There was a crack in the sidewalk about twenty-three feet from the front porch and when she reached the crack she sat down. Although the crack was more prominent than the small spaces between successive blocks, the sidewalk had not buckled and thus presented no physical barrier. We stood her up and held her wrists as she crossed, walking her back and forth over it. Still she failed to cross the crack without assistance; so we moved the other

chair directly over it. Over several days we inched the chair back until the crack was directly under its front legs. We continued backing up the chair and the problem did not reappear, even when Claudia had to cross the crack entirely to reach the opposite chair. We did, however, sporadically see similar behavior throughout her training. A crack, a parking stripe, a change in sidewalk color, and the like occasionally stopped her. A gentle push and she crossed; stopping did not interfere significantly with her progress.

Having solved the crack dilemma, we moved the chairs apart at the rate of about one foot per week until we reached forty-seven feet, the full length of the sidewalk. Unlike her behavior while walking indoors, she did stop and sit down occaionally before reaching the chair. In these circumstances, we stood her up, made her walk back to the chair from which she had departed and start again. This did not occur often and was of no major concern.

During the between-chairs walking sessions, her step size increased to about one foot per step and her rate was stable at just over a hundred steps per minute. The rate remained constant-- on level surfaces-- throughout her training, while her step size increased to one foot, five inches.

Auxillary Skills I: Into and Out of Chairs

Soon after we began the between-chairs walking program, it occurred to us that teaching her to walk was not sufficient. If Claudia was to learn to walk independently, she would need a variety of auxillary skills, such as standing up, sitting

down, climbing stairs, and walking over rough terrain. We therefore designed a series of programs mostly composed of the popular technique of "shaping" and "fading," guided always by Claudia's charted performance. We built each behavior slowly and insured that Claudia could employ the skill in a variety of settings.

If we expected her to use her new walking skill, we had to teach her to initiate it. Consequently, our first new programs were designed to teach her to get into and out of chairs and to get up from the floor, where she spent a considerable amount of time.

We had been giving Claudia as little help as possible getting out of her chair during the early stages of the between-chairs walking program, and she was almost able to accomplish the task on her own. Once out of the chair, however, she had to walk quite a distance for her food and we reasoned that if we placed the food closer to the chair she might stand up without assistance. At one end of the cottage hall stood a clothes dryer and an ice machine. We placed her chair one and a half feet in front of the ice machine and set the spoon on top of it. Arms outstretched, she rocked forward several times, finally gaining enough momentum to stand and brace herself against the ice machine, whereupon she received the food. We continued the procedure for two weeks, timing each entire session of about five minutes and counting the number of times she successfully got to her feet (Figure 14, phase A). She quickly reached a

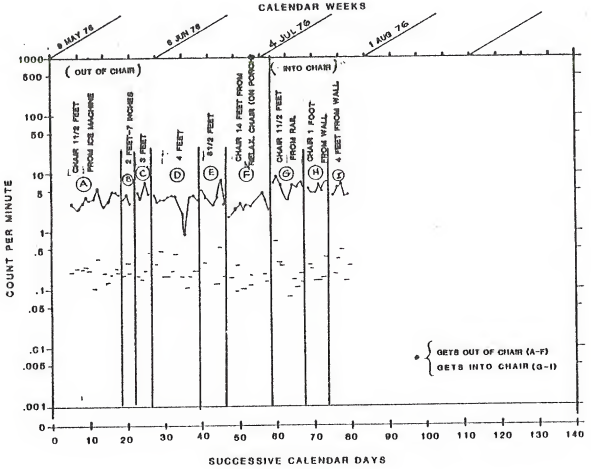

Fig. 14. Gets into chair and gets out of chair (trial completions per min.).

rate of about five per minute, the maximum she could obtain accounting for the time spent receiving and chewing the food. We subsequently moved the chair further from the ice machine, and when we ran out of room in the hall, we moved the session to the back porch and placed the spoon on the relaxation chair (phases B through F). On the porch, she was walking fourteen feet from chair to spoon.

We increased the distance in this fashion for two reasons. First, she was initially barely able to rock herself out of the chair, and having gained her feet, her balance was not good. During the first phase of training she could catch herself on the ice machine. When her balance improved, we moved the chair yet further, and standing and walking became a smoothly executed movement.

The second reason for moving the chair back was to insure that she could execute the standing up motion without immediate reinforcement. Her progress was reflected in the between-chairs walking program, in which her trainers no longer had to help her out of the chair. Faced with the ever increasing distance between the chairs, she occasionally balked. However, a few tugs on her sleeve sufficed to get her started.

Having taught Claudia to get out of the chair without assistance, we approached the problem of getting her into the chair. We began on the back porch, with Claudia in the chair facing the guardrail, about one and a half feet away from it. We had her stand up and grasp the rail, then lower herself

into the chair while letting go (phase G). We counted and timed each behavior as before. This was fine, except that we had merely succeeded in replacing ourselves with the rail; Claudia still needed assistance in getting into the chair. We planned to move the chair back gradually and eliminate the rail, as we had eliminated the ice machine when teaching her to get out of the chair. When we considered the motion required to seat oneself, we realized the folly of our scheme. Unless one is very tired or otherwise indisposed, one generally approaches a chair from the front and spins about, simultaneously lowering oneself onto the seat. Such a complex response, or even a chain of simpler responses with the turning and lowering trained separately, was beyond either Claudia's capability or our teaching skills.

We elected instead to teach Claudia to use the back of the chair for support. We moved the program back into the hall. We placed Claudia in the chair, seated parallel to the wall, about one foot away from it. The trainer assisted her to stand up and put one hand on the wall, placing the other on the chair's backrest. From there, she could lower herself into it (phase H). When she was able to execute the motion without her trainer's help, we moved the chair three feet further from the wall so that Claudia had to walk to it and seat herself using the backrest and the seat of the chair for support (phase I). This manner of sitting down proved successful. Without specific training she applied the process to any chairs, couches, and benches she encountered.

In the process of teaching her to sit down, however, we learned another lesson of profound retardation: conduct each training session with complete regard for all other training in progress. In our eagerness and impatience to teach Claudia to get into the chair we had assisted her in getting out. We succeeded in speeding up the into-chair training sessions, but she would not get up on her own during the between-chairs walking program. We temporarily had to reinstate the out-of-chair procedure. During the retraining, we patiently allowed her to seat herself.

Auxillary Skills II: Standing Up from the Floor

There were only a few chairs in the cottage day room, and at our insistence, a bench had been installed. These were usually occupied by the higher-level clients, leaving the floor to the lower-functioning and non-ambulatory clients. Since we usually found Claudia on the floor, it was imperative to teach her to get up and start walking on her own.

We began by offering her our hands. We did not pull her; we merely extended our hands and let her pull up, whereupon she received the spoonful of food without which we could induce her to do absolutely nothing. We then reseated her and repeated the process for about two minutes. She pulled herself up in this fashion slightly less than twice per minute (Figure 15, phase A), and we wondered if we might have more success by substituting inanimate objects for ourselves.

We used the dryer in the hall, placing Claudia directly in front of it and the spoon on top of it. Rocking forward,

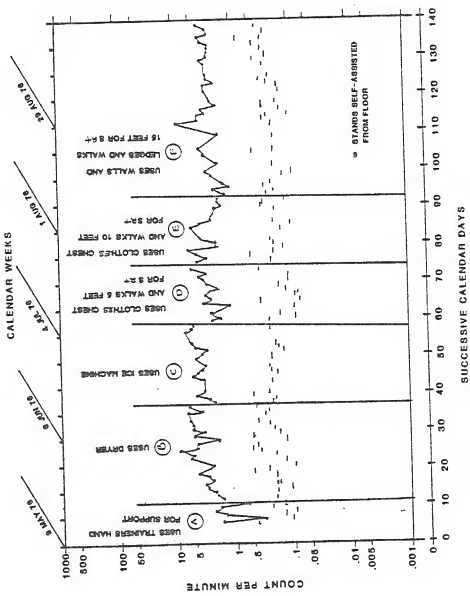

Fig. 15. Stands from floor, self-assisted.

she placed her hands on top of the dryer and pulled herself to a standing position without assistance from the trainer. We timed the entire session as we had before, counting the number of times she stood up. She initially stood up twice per minute and increased the frequency to seven per minute in three and a half weeks (phase B).

Although Claudia proficiently used the dryer to stand up, we wanted to insure that she could similarly use any available object. A behavior learned in one setting will frequently fail to occur in other settings without explicit programming (Rekers & Lovaas, 1974; Stokes, Baer, & Jackson, 1974; Koegel & Rincover, 1977). We therefore conducted the session in a variety of locations, moving from the dryer to the ice machine, clothes chest, and various walls and ledges (phases C, D, E, F). As we had done when teaching her to get out of her chair, we required her to stand and walk increasing distances before she received her food. During the latter portion of this program, her trainers would no longer help her up when they arrived for her mealtime sessions, requiring her instead to employ her new skill.

During the final two weeks of the program, we noticed that she was barely using the walls and ledges for assistance. We therefore added a new program, requiring her to stand entirely unassisted. She used the same basic strategy that she had developed to get out of the chair, rocking forward with arms outstretched until the momentum brought her to her feet. During the first phase, we delivered the food as soon

as she was standing (Figure 16, phase A). For the next nine weeks, we conducted the session almost daily, requiring her to walk three or four steps for food (phase B). Thereafter, we maintained the session sporadically eventually delivering the food on a VR2, then VR3 schedule (i.e., food on an average of two, then three trials; phases C, D). When we eliminated the program altogether, she was able to stand up about ten times per minute, for three minutes at a time. Although one might have expected the variable food-delivery schedule to maintain a higher response rate than that maintained by a continuous schedule (Reynolds, 1968), such was not the case in Claudia's stand-up program. She was probably not physically capable of executing the performance faster than ten times per minute. Neither was I: Matching her stand-up for stand-up, I was embarrassed to discover that I looked considerably worse for wear than did she, and I was not simultaneously trying to chew and swallow.

The Daily Constitutional, Part I

About a month after we began the between-chairs walking program, we realized that while Claudia was progressing nicely, she was not getting very much practice. Most of the walking was in a straight line, met by food at each stop. The remainder of her walking occurred in the cottage and covered very short distances. We had taught her the skills necessary for more extensive walking, but she did not use them. If her walking was ever to amount to anything, we clearly had to expand her training.

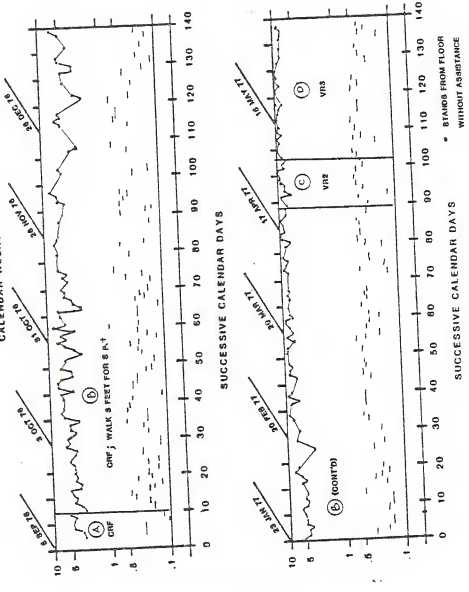

Fig. 16. Stands from floor, unassisted.

The afternoon was the best time for such an undertaking, since she was with Julia for a large portion of the morning, and we went home shortly after supper. Our training building was located several hundred yards from the cottage and seemed a likely target. It was August, and the air conditioned building offered a break from the vicious heat before the return to the cottage. The building was also stocked with enough balls to amuse Claudia for hours. We knew that Claudia could not make the entire trip on her own, and we therefore abandoned our policy of providing no assistance. By this time, she was walking fairly proficiently inside the cottage, and we gambled that providing assistance during her walk would not affect her indoor program. We gambled correctly, but it was small consolation for Georgianne, who spent the hottest summer of her life between Lilac and the STARS building. Everyday she and Claudia left from Lilac's backdoor and followed driveways, streets, and sidewalks to arrive exhausted at our building (Figure 17).

Some parts of the route were rougher than others, and in these Georgianne held Claudia's wrist firmly. In the smoother sections, Georgianne walked close behind Claudia, and when she began to sit down, Georgianne held both her arms straight up to prevent sitting. Georgianne would then do her best to start Claudia walking again, supporting Claudia by the armpits and moving her forward. If repeated attempts to initiate walking failed, Georgianne took Claudia's wrist and assisted her until Claudia was walking smoothly again, ready for another

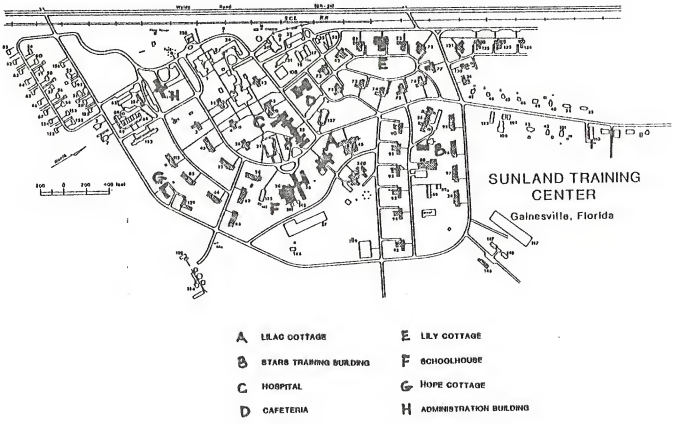

Fig. 17. Site plan of Sunland campus.

try at independent walking. They both rested every few hundred feet. Georgianne counted the number of independent steps and attempts to sit down on the way to the STARS building (Figure 18, phase A). A one-way trip was enough, perhaps too much, and we returned Claudia to the cottage by assisting her throughout the walk.

A one-way walk required about 1300 of Claudia's small steps, and during the first two weeks the only change was in the condition of Georgianne's back. Georgianne therefore devised a new, less taxing procedure, placing her knee under Claudia's seat to prevent sit-downs (phase B). Both her back and Claudia's walking improved. Claudia averaged nearly 350 independent steps per journey, more than twice as many as before.

In September, we added several features to the program, and the sitting improved further. Claudia's parents bought her a new set of tennis shoes to replace the worn-out, heavier saddle shoes in which she had learned to walk. Georgianne also brought a ball along for the walk which she placed 200 feet ahead of Claudia for use during rest breaks. The most significant change was probably the new route we chose, leaving from Lilac's front door and following sidewalks most of the way. The number of independent steps jumped to over a thousand, and within five weeks Claudia could walk most of the route on her own (phase C). The number of attempts to sit down changed little over the course of the program. This was further evidence of Claudia's progress, since there

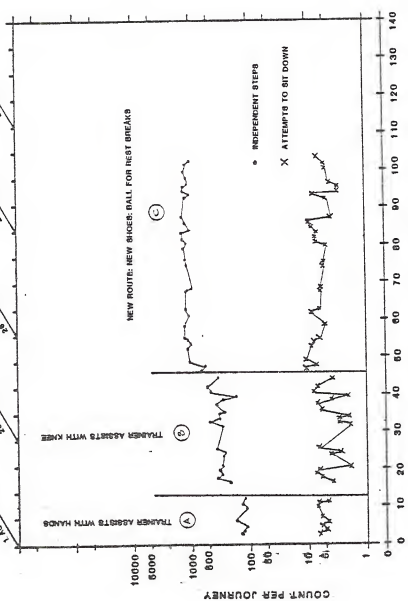

Fig. 18. Walking from Lilac Cottage to STARS training building. Data are count per one-way journey.

was one attempt for each twenty-five independent steps when she began and one in 250 in the latter portion of the program.

The Daily Constitutional, Part II

Georgianne left the STARS Program in late September, and I continued the after-lunch walking sessions while interviewing applicants for the vacant position. I hired Cindy, who tolerated the walking sessions for about a month before pointing out a problem. Hadn't I noticed that Claudia's attempts to sit down no longer appeared when she encountered rough spots enroute to our training building? Rather, Claudia would turn to walk in a different direction; we would re-orient her toward our building; and only then would she sit down.

It was true; I had fallen into a rut. In my desire to see Claudia walk to the STARS building without any assistance, I had not considered alternatives to the daily ritual.

We let Claudia choose the direction of her daily constitutional. As long as she walked for about half an hour each day, we didn't care where the walks occurred. In fact, the new policy had many advantages. Claudia learned to walk on grass, dirt, bumpy streets, and the like, without explicit programming. Her trainers were pleased, as they had an opportunity to explore other parts of the campus. We expanded the session to included short strolls after breakfast and dinner.

Claudia became increasingly attentive to the environment. She began looking around her, at people, moving vehicles, and

objects and buildings. Her favorites were the small, manually operated merry-go-rounds that were located in almost every playground. She would spot one of these from several hundred feet away and walk over. We could spin her until we were exhausted; the faster we pushed, the more she laughed. In inclement weather, she frequently walked inside the campus hospital, where she was a welcome visitor. She rode the elevators and walked endlessly up and down the halls, exploring the wards and lounges. Many of the staff had known her before, and their exclamations at the change in her made us redouble our efforts.

We tried a number of recordkeeping formats to monitor her progress, and after several months settled on a general measure of assistance. Her trainers counted as an assist any instance in which they either had to catch her to prevent her from falling, or give her a small push when she balked at something in her path. The assists gradually decreased from about one every two minutes to about one in twenty minutes, or several per walk (Figure 19). I purchased a pedometer to obtain a measure of distance, but the records were unreliable due to her swaying gait. We eventually merely recorded the amount of time she spent walking each day and kept a log of the places she went. These were sufficient to keep track of the program.

Claudia's hands and arms also provided us with an informal measure of her improvement. During the early stages of walking, she always kept her hands up and out to her sides, arms

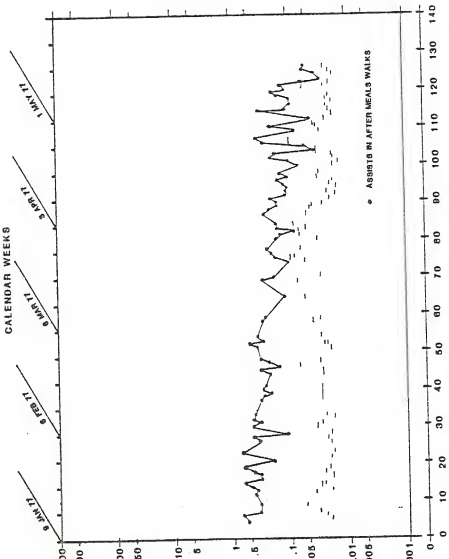

Fig. 19. Trainer assists during after-meal walks.

flexed at the elbow. Over the months, she gradually lowered her arms. Eventually, she walked with them hanging loosely at her sides, raising them only when crossing rough terrain.

In the early part of the program, Julia continued to take Claudia out in the wheelchair. We did not object. Keeping Claudia on the move was strenuous work, and Julia was elderly. However, as the walking improved, the other foster grandparents chided Julia, who eventually succumbed to peer pressure and abandoned the wheelchair. This pleased us immensely, since we knew that we would eventually have less time to spend with Claudia. We now had a guarantee that the walking would be maintained. Further, we did not have to push for the change; the goad had come from others who had noticed Claudia's progress.

Auxillary Skills III: Climbing Stairs

During the last few weeks of Claudia's walks to our training building, she seemed sure-footed enough to learn to walk up and down stairs. Because of the operation, her rigid ankles would probably never allow her to scale steps without support. However, teaching her to use a support rail or bannister seemed a reasonable goal.

The front steps of Lilac were a likely beginning. There were only three shallow steps, each three and three-quarter inches high, leading to the porch which was surrounded by a steel rail. The rail terminated at each side of the top step, and, although there was no bannister, Claudia could easily reach the rail from the foot of the steps.

We had previously been assisting Claudia whenever she encountered steps, holding both her hands tightly and bracing her against us. We had noticed that it was easier to help her up the steps than down, so we began by teaching her to go up.

Since we had always assisted her ourselves, our first task was to teach her to grasp the rail. We started her on the sidewalk about five feet from the bottom step, had her walk to the foot of the steps, lean forward and grasp the rail, whereupon she received the familiar spoonful of food. She learned to grasp the rail with both hands within a week, and we began working on the actual step-climbing.

We continued the procedure as before, giving her a five-foot start, but now we walked ahead of her and waited on the top step. We counted the number of stairs she scaled, starting the timing on each trial when she began walking and turning off the watch when she had both feet on the top step. She learned the skill quickly, increasing from the original nine stairs per minute to fifteen stairs within several weeks (Figure 20, phase A). We worked next on walking down, giving her food at top and bottom, but counting and timing only while she descended (phase B). We then briefly returned to monitoring only while she walked up (phase C), to be sure she had not lost her former speed in this component. We completed the program by recording the rate at which she both ascended and descended the stairs (phase D).

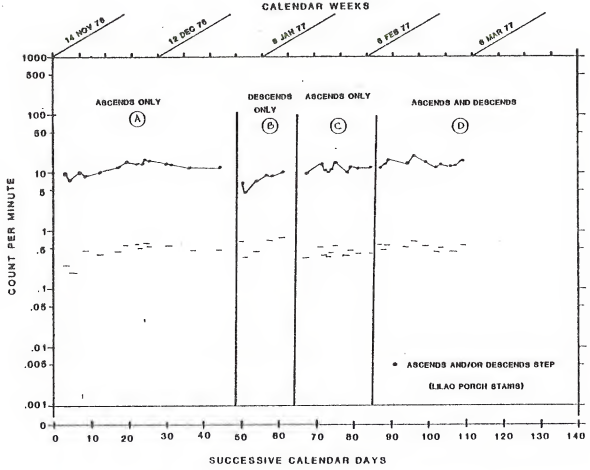

Fig. 20. Walking up and down Lilac porch steps. Data are stairs ascended and/or descended per minute.

Claudia was ready for a new set of steps, but none were to be found. Due to her limited walking, there were no other stairs with support rails within easy access from Lilac, so the program was temporarily stalled. Her trainers worked with her on stairs they encountered during her after-meal strolls, but we did not wish to feed her at these times, and without food, getting her to climb was usually a struggle. We ordered a set of wooden playground stairs, with five six-inch steps and support rails. While we awaited delivery, we continued to practice on the front steps of Lilac.

When the new set of steps arrived, Claudia both ascended and descended them as well as she could the cottage's more shallow front steps, probably because of the bannister. She received her food after completing all five steps. There was, however, a new problem. When walking up, Claudia frequently took two steps at a time, and in doing so occasionally tipped backward. To eliminate the behavior, we blocked with our feet each attempt to take two steps, pushing her feet back to the appropriate step. The attempts slowly decreased as she learned to climb the steps more rapidly, beginning at about twelve stairs per minute and increasing to over twenty-five. We began using the left side (facing) bannister and later switched to the right side (Figure 21, phases A, B).

Claudia descended the steps only slightly more slowly than she ascended them. She did not attempt more than one step at a time, but at first required her trainers' assistance to keep her hands on the rail and to keep moving (Figure 22,

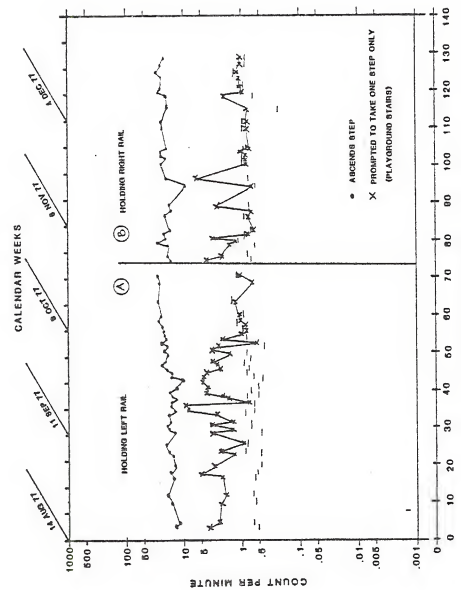

Fig. 21. Ascending playground steps.

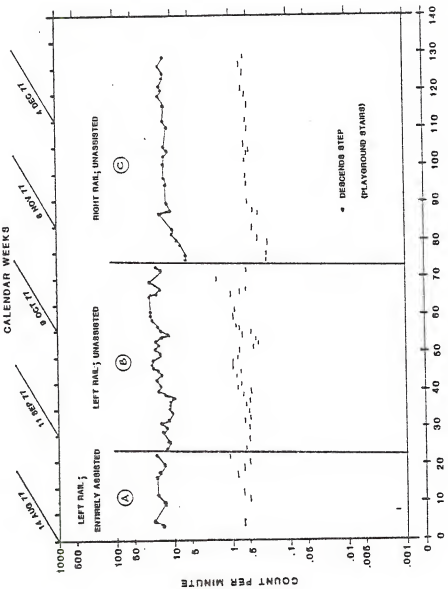

Fig. 22. Descending playground steps.

phase A). She soon needed no assistance, and we proceeded in the same manner as in the up-steps component, using the left, then right rails (phases B, C).

By the time Claudia reached what was apparently her top speed on the playground steps, her walking speed and balance were sufficient to permit us to find new stairs for practice. The hospital had several outdoor staircases with rails, and we made use of these, practicing on each set until she climbed up at the rate of at least twenty steps per minute and down at at least fifteen.

Her proficiency was reflected in her after-meal walks. We no longer had to struggle with her to climb stairs, even when no food was in the offing. The skill opened new avenues of exploration for Claudia and made our time with her far more pleasant.

Auxillary Skills IV: Crossing Obstacles

Although Claudia was learning to walk over many surfaces, any transition (sidewalk to grass, etc.) or obstacle higher than about one inch caused her to stumble or to stop walking and hold out her hand to her trainers. She was improving, but we sought to speed up the process by carefully programming a series of obstacles of known dimensions. As she became proficient at crossing each, we added to it, increasing the difficulty only slightly. We ordered a set of boards which arrived in August, 1977, at the same time as the playground steps.

We conducted the session in much the same manner as we had the between-chairs walking, placing two chairs eight feet apart on the sidewalk in front of Lilac. The first obstacle was a single board, one and a half inches high and three and a half inches wide, centered on the walk between the chairs. She walked from chair to chair ten to fifteen times, receiving her food and a brief rest at each stop. We counted the number of times she crossed the boards, operating the stopwatch between the time she left one chair and arrived at the other. We counted an assist if we had to push her when she balked, or if she bent over and used her hands to help herself clear the board. She learned to cross the board quickly (Figure 23, phase A), and we moved the chairs eleven feet apart, placing another board parallel to the first and centering both between the chairs. Again she performed well (phase B).

We increased the height of one of the boards to three inches, leaving the other at one and a half inches. The number of assists rose sharply, but declined within a week (phase C). We continued the sequence by increasing the height of the second board to three inches, but Claudia apparently disagreed with our logic. The number of assists, which began at one in every ten boards, increased to an assist for every other board (phase D). I briefly tried replacing the second board with one only one and a half inches high, but within several trials, I could see the problem had not disappeared. I removed the smaller board entirely and centered the single,

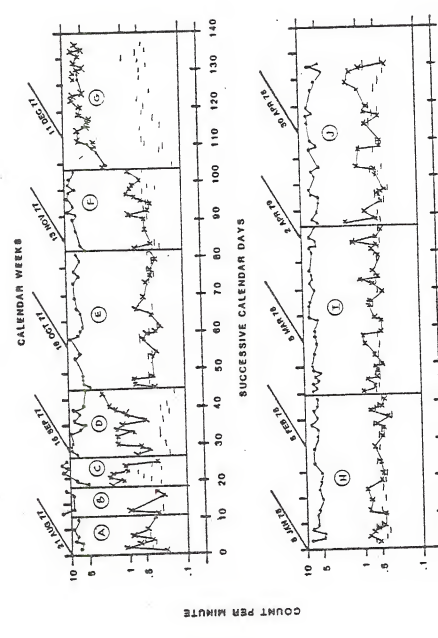

Fig. 23. Crossing obstacles. Obstacles were placed between two chairs; record floor is total time spent walking between the chairs. See text for description of phases.

three inch board between the chairs. We retained this configuration for five weeks (phase E), then successfully added the second, one and a half inch board (phase F).

I was unwilling to increase the height of the second board to three inches and risk failure a second time. Instead, I changed the obstacle from a board to a small platform, two and a quarter inches high and one and a half inches wide. This was considerably more difficult than the previous task, requiring Claudia to step up on the platform, gain her balance, and then step down. I therefore changed our policy of providing no assistance except a gentle push. Each time she approached the board, I placed my thumb and index finger under her right wrist to help her balance. I did not want to hold her hand, fearing that it would be difficult to gradually reduce the amount of assistance. She rapidly learned to get up on the platform, and stepping down was never a problem. I assisted her in this manner on almost every attempt, although several times she was up on the platform before I was ready for her (phase G).

Fortunately for Claudia, I had to leave for several days, and Kris, a new trainer, conducted her sessions. Through a miscommunication, Kris thought that she was supposed to assist Claudia only when Claudia balked at the platform. This, in fact, was all the help that Claudia needed, and we continued to train under the new policy (phase H). We successfully raised the platform to three inches (phase I), then four and a quarter inches (phase J).

Claudia's walking skills had progressed markedly. She balked at fewer obstacles and crossed rough terrain more easily. The improvement was most obvious when she encountered low curbs. Prior to her training with the platform, she had never surmounted a curb on her own. When the platform height reached three inches, we could induce her to scale the curb with a bit of gentle pushing, and when the platform was raised to four and a quarter inches, low curbs were no longer a problem.

Claudia could truly walk by herself.

The Campus Cafeteria

Getting There

Marsha left the STARS Program in mid-November, 1976. During her last week with us, she instituted a change that affected the entire program. We had just eliminated Claudia's walk from Lilac to our building. If Claudia could now walk where she pleased, Marsha reasoned, why couldn't she walk to the campus cafeteria? It was located less than two hundred yards from Lilac. As much as Claudia enjoyed eating, it should not be difficult to induce her to make the short trek. Her feeding skills were hardly polished, but she could handle a spoon, and the relaxation chair was adding nothing to the program.

The change was made and Marsha departed for her new job. Cindy, Mardi, who replaced Marsha, and I were left to continue the program. Once again, the unexpected happened. Claudia

might walk well after meals, when she chose the direction, but going to the cafeteria was another matter. Once there, she seemed to enjoy it, making her excited noises and gestures, smiling and laughing at all the activity. But we had to struggle to get her there. Perhaps it was because she had always eaten at the cottage and then gone for her walk; we were attempting to leave Lilac before she had eaten. Most of her struggling and attempts to sit down occurred on Lilac's front sidewalk. Once past the walk and away from Lilac, the going was easier.

We considered taking food or juice to feed her periodically along the way, but decided against it. She had been walking considerably further without food for several months and adding food now would be a step backward. This was probably an incorrect decision. We assumed that she could make what was for her a relatively long journey because there was food at the end of it. How could we expect her to make the whole journey right from the start? We had worked with her for almost a year, painstakingly building each skill a little bit at a time. Now we were trying to effect a major change with no preparation at all. Claudia's trainers sometimes learned as slowly as did she. Nevertheless, we kept trying, using the same procedure as we had during Claudia's walks to our building, and finally succeeded. After several months, Claudia walked the entire distance without help or urging from us. Eventually she laughed and walked at her maximum speed, a hundred and forty feet per minute, en route

to eat, coming as close as she ever did to actual running.

Meanwhile, the rest of the STARS Program followed our lead. In time, most clients who learned basic feeding skills began eating at the cafeteria. It was a pleasant and rewarding change from the confines of Lilac for clients and trainers alike.

Eating Skills in the Cafeteria

During the first six months in the cafeteria, we did nothing more than continue Claudia's scooping program. We were assisting her with every scoop when we arrived and later assisted her only when necessary (Figure 9, pp. 63-66). As her walking was still rather limited, we did not attempt to have her go through the food serving line. Rather, we seated her, brought her her food, and returned her tray to the disposal window after the meal.

By the end of June, 1977, Claudia could use her spoon with little assistance. We decided that it was time for her to learn to use a fork. Forks had not been available at Lilac, but they were at the cafeteria. Many of the higher level clients at the cafeteria could not use forks, but the program seemed worthwhile since many items, such as salad, were more easily stabbed than scooped.

During each meal we allowed Claudia to eat most of her food with her spoon, setting aside any chunks that would be easy to stab with a fork. We then placed the fork in her hand and assisted her in stabbing the first few chunks. Thereafter, we gave her an opportunity to stab each piece.

If she failed after several attempts, or if she tried to scoop with the fork, we assisted her in stabbing that chunk. The strategy did not work. She was not putting any force into her stabs and rarely succeeded in spearing her food (Figure 24). We tried assisting her with every chunk for the next two months, but we observed no increase in force. She was no closer to success than she had been when we started the program, so we terminated it. Using a fork was not vitally important to Claudia's eating skills, but our failure to teach her was yet another disappointment in this difficult area of her training.

We met with considerable success, however, in teaching Claudia to handle her cup. We had always assisted her with this task, since if we did not, she would pick up her cup, take a drink, and then drop the cup, whether or not liquid remained in it. Claudia normally paused only two or three times while drinking, giving us few opportunities to replace the cup on the table. To increase the number of opportunities, we placed only a sip or two of juice in the cup for each trial. For three weeks, we allowed her to pick up the cup and drink the juice by herself. As she brought the cup away from her mouth, we grasped her wrist firmly and guided her hand to place the cup upright on the table, releasing her wrist when she had released the cup. At first we had to do all the work; we could feel the resistance as we guided her hand. Gradually the resistance decreased and at the same time she learned to release the cup as soon as she had placed it on the table. We

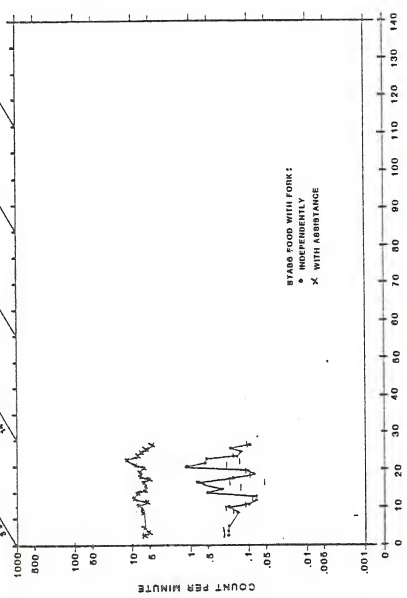

Fig. 24. Fork use.

replaced the all-assisted procedure with one in which she was given the opportunity on every trial to replace the cup on the table by herself. If she dropped the cup or set it down sloppily so that it tipped over, we counted an incorrect response, replaced the cup in her hand and assisted her to set it down correctly. During the next two months, the incorrect cup placements decreased from about one in every four attempts to fewer than one in twenty (Figure 25). We could then safely give her the entire cup of liquid at once. She never dropped it, but she occasionally set it down on top of her silverware, allowing it to tip over. This happened rarely, and the mess created was well within the limits tolerated by the campus cafeteria, where spills, dropped trays, and other accidents were a common occurrence.

Claudia also spilled a considerable amount of liquid while she drank. She held the cup at too sharp an angle and frequently left it there when not swallowing, allowing the juice to run out of her mouth and onto her bib. We never succeeded in eliminating the spills, but the amount of liquid spilled decreased sharply after she learned to handle the cup. After that program was terminated, she always lowered the cup when not actually drinking. Interestingly, she did not replace the cup on the table during each pause, a by-product we were afraid the program might have produced. Rather, she often lowered the cup momentarily, then resumed drinking. She was not exactly fastidious, but she could definitely drink without our assistance.

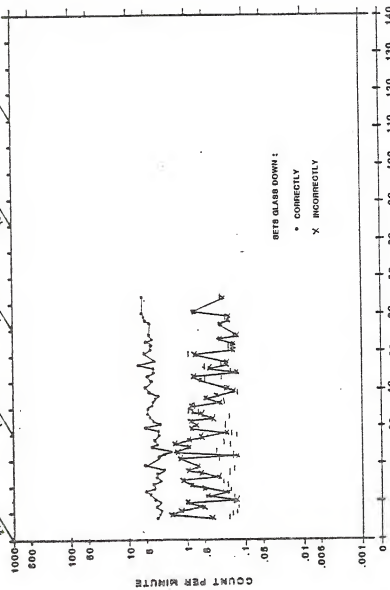

Fig. 25. Setting cup down after drinking. Incorrect response was recorded if cup toppled over.

The Serving Line and Carrying the Tray

In late 1977, when Claudia had been eating at the cafeteria for about ten months, her walking skills were advanced enough to allow us to teach her to carry her tray. We designed two programs, one to occur in the cafeteria at mealtime and one to take place at Lilac.

When we arrived at the cafeteria, we seated Claudia and took a place in line. At the head of the line, we brought Claudia over and assisted her through the entire process, guiding her hand to take silverware, dessert and main course dishes, and a drink. We used spoonfuls of food to induce her to push her tray, replacing her hands on the edges and prompting her to push when necessary. At the end of the serving line we stood behind Claudia, made sure she was grasping the tray firmly, held the tray lightly ourselves, and guided her to the nearest table. After the meal, we used the same procedure to guide Claudia to the disposal window. We reserved more intensive training for extra sessions at Lilac. The cafeteria was crowded, and we did not wish to add to the confusion with the dropped trays, spills, and stalls we knew would accompany the program.

The kitchen counter in Lilac, about ten feet long, was perfectly suited to our purposes. We placed a bowl of blend on a tray, arranged Claudia's hands on the edges, took the spoon, and had her follow us, sliding the tray. When she reached the end of the counter, she picked up the tray and carried it back to the starting point, ready to begin the

next trial. We conducted about fifteen trials per day. At the beginning of this portion of the program, we gave her two spoonfuls of food per trial, one about half way down the counter and one when she returned to the starting point. After several weeks, we gave her only one spoonful at the end of each trial. We assisted her when necessary, replacing her hand on the tray as she pushed it or leveling the tray if it tilted while she carried it. At the beginning of the program, we were not always as quick as we should have been and had to clean and mop the kitchen floor regularly. Our assists gradually declined to one or two per session, while her rate of trial completion (we timed only during trials) rose from less than two per minute to approximately five per minute (Figure 26, phase A). By the end of this training phase, we no longer had to prompt her to push the tray in the cafeteria line, so we concentrated on teaching her to carry it.

Claudia now carried the tray from the end of the kitchen counter into the hall, to the clothes dryer, about fifteen feet away, where she received her food. Each session consisted of about fifteen trials, or one-way trips. We assisted her in leveling the tray whenever the bowl of blend began to slide (phase B). Although she rarely tilted the tray enough to dump the blend before we could catch it, we were not satisfied with the program. The blend bowl was too heavy to be a sensitive, reliable indicator of tray tilt, and we could not trust our vision because the tray jiggled considerably when she walked. We solved the problem of finding

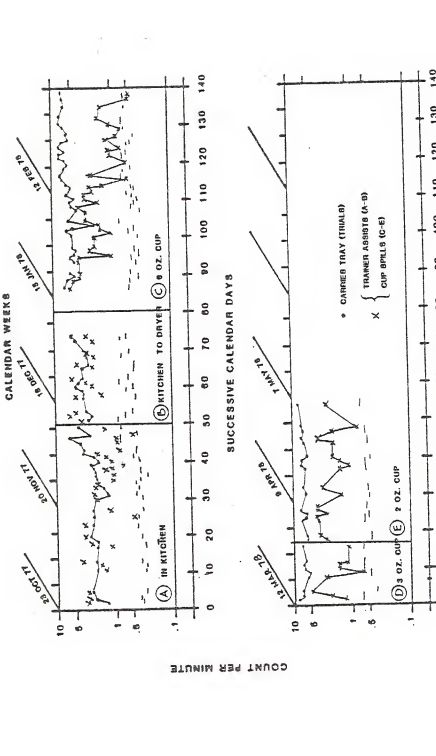

Fig. 26. Carrying food tray. Assists (X) not connected in phases A and B for printed clarity.

a sensitive, mess-free criterion by placing a steel weight in the bottom of a plastic cup. The cup and anchor weighed about six ounces, enough weight to prevent the cup from toppling at the slightest jostle. When the cup did fall, we righted it, adjusted the angle of the tray, and counted the occurrence. As Claudia gained speed carrying the tray, the cup fell less and less often (phase C). When the cup was falling less than once per ten carries, we replaced the steel weight with a wood block, decreasing the total weight to about three ounces (phase D), then used an empty cup, which weighed two ounces (phase E).

In the cafeteria, we stopped "shadowing" Claudia and holding her tray at the same time we replaced the steel weight with the block. However, we remained only inches from her as she carried the tray to her table, or to the disposal window after meals. When the block was removed from the cup, we were able to stand several feet from Claudia in the cafeteria. She did occasionally dump the tray, but accidents of this nature occur periodically among all but the highest-level clients. As was also common practice among the cottages attending the cafeteria, we carried Claudia's juice cup for her when it was filled to the brim: We could not reasonably expect her to perform a task that we ourselves had trouble executing.

We were unable to teach Claudia to go through the serving line independently. She eventually learned to pick up silverware, but never discriminated knife, fork, and spoon. Without

our assistance, she put her hands into one of the bins and extracted one or more of whatever happened to be in that bin, but there the learning ceased. Progressing through the line, she usually needed assistance to take the food dishes. The assistance usually consisted of pushing her hands toward the dishes. Once aimed in the right direction, she would usually take the dish, occasionally requiring additional assistance to place it on the tray without spilling the contents.

Watching Claudia go through the serving line and take her tray to the table, I thought back to the time, a year and a half earlier, that we began walking her to the cafeteria. It had been such a struggle to make her walk that we had nearly abandoned the program. How unfair to her it would have been had we done so.

Final Aspects of Training

Exploring Out the Gate

Ask a "high-level" where he or she would like to go, and the answer is frequently "out the gate." The Sunland campus is neither locked nor hidden behind massive walls. It is, however, bounded by fences, and many clients rarely leave the premises. Going out the gate is a treat-- a shopping trip or an afternoon of bowling with a volunteer sponsor, or a group outing to a concert or sports event. Advanced clients earn special status by attending off-campus schools or by gaining employment in the community, and the most advanced can leave the campus permanently to reside in a group living home.

Our clients had seemed to enjoy the first off-campus picnic at the lake, and field trips became an important part of the STARS Program. Although the clients were nonverbal and could not ask us to take them out the gate, their excitement as they boarded the bus on Saturday and Sunday mornings was proof enough, and several of them invariably became sullen and cried when we returned to the campus.

The field trips were a welcome break in routine for both clients and staff, and provided a chance to practice newly learned skills in novel environments. For those of us working with Claudia, the field trips were a way to watch her grow. We brought a wheelchair for her on the first picnic; we had just begun her walking program, and she took but a few independent steps in the grass at the lake. The wheelchair was soon unnecessary, and, with her trainers' prompting and coaxing and with frequent rest breaks, she was able to keep pace with the expanding scope of STARS field trips. We attended local events such as parades and the circus, visited parks and other attractions, and ate at several restaurants.

During this time, the number of stimuli to which Claudia responded increased markedly. Loud noises, music, brightly-colored fast-moving objects, and large groups of people attracted her attention. She watched intently, grew excited, laughed, and walked without prompting to explore her surroundings. Her love of motion, which we had discovered when riding her in the relaxation chair, continued. Rides at carnivals were the most exciting, but she even enjoyed the bus rides,

laughing at the sight of the bus parked at Lilac's back door. As she progressed in her ambulation training, she learned to board the bus and seat herself without assistance.

In the spring of 1977, a year after the first picnic, the STARS took an all-day trip to Disney World. It was a big event for us and required all the skills we had taught our clients. Watching Claudia walk through Disney World and enjoy the attractions, I could see clearly the effects of her intensive training. It was a fine professional reward.

Expanding the Daily Constitutional

Marsha returned to work in the STARS Program just before the trip to Disney World. Although she had visited periodically during her absence, her new, close contact with Claudia provided her an excellent perspective for comparison. When she had left the program, Claudia was slowly, painfully learning to walk to the cafeteria. Noting the improvement in ambulation skills and, particularly during the day at Disney World, Claudia's progress in other areas, Marsha suggested that we begin taking Claudia off-campus more frequently.

Claudia's afternoon walking session, which originally seemed to offer an endless supply of new environments, had become somewhat confining. Claudia could walk to almost any point on campus, limited only by time. Interspersing off-campus trips with these walks would provide a fresh supply of novel situations. A five-to-ten minute drive gave access to a variety of parks, playgrounds, shopping areas, and local events. Riding in the trainer's car was, of course, half the fun.

We maintained data regarding the off-campus trips in the same fashion that we monitored her on-campus walking, keeping a chart of walking time and a log of places visited. The number of stimuli to which Claudia was exposed multiplied dramatically.

Social Behavior

During my time with her, Claudia made many changes besides those described in the preceding pages. These changes are perhaps best labeled as social behaviors or "responsiveness to others." Although these changes were among her most important and advanced accomplishments, we unfortunately did not quantify them for a variety of reasons. As other researchers (e.g., Harris et al., 1964; Risley, 1968) have found, the social behaviors emerged largely as a by-product of her training and as such were never monitored closely. We were often unaware that a behavior was emerging or changing until the change was so obvious that we could not have ignored it had we tried. The lack of data deprived us of an opportunity to study the development of the new behaviors, but we apologized to ourselves by noting that our measurement and training efforts were directed to the more immediate priorities of rumination, ambulation, feeding, and the like. We did not know why these other changes occurred but were grateful for them.

During my last year in the STARS Program, Claudia began to laugh considerably more often and began, albeit infrequently, to respond to her name. On her walks she gradually

began to follow her trainers; earlier, we constantly had to physically steer her in the desired direction.

Most notable was the change in the amount of physical contact she had with us. Many of the trainers would gather after meals in Lilac's lounge or outdoors to relax, monitor the clients for self-abuse, and to give the clients extra time out of the cottage. During these times we played with Claudia, tousling her hair, patting her stomach, and otherwise physically interacting with her. Claudia was originally indifferent to these overtures, ignoring them or pushing our hands away, preferring instead to bounce her ball. Gradually, she began to tolerate the contact and then to seek it. If we seated her across the lounge, she would walk over and sit beside one of us, taking our hands in hers and placing them on her head or face.

When we finally became aware that these social behaviors were emerging, we undertood to teach a specific response, hugging. To our discredit, we again failed to collect quantitative data, and thereby deprived ourselves of yet another opportunity to study a significant aspect of Claudia's growth. The training was simple and informal. We took advantage of her newly acquired behaviors of approaching and touching us. At various times while she walked, her trainer walked ahead of her, then stopped and waited. She generally walked up to the trainer and stopped. When she did so, the trainer bent down and placed her arms in hugging position, directly around the back. The trainer reciprocated the hug, patting her back

lightly for a few seconds, then resumed the walk. We were quickly able to eliminate physical assistance. Within several weeks we needed only to tug lightly at her arms or gently nudge her elbows to initiate a hug, and even these prompts were soon rarely necessary.

Of all Claudia's trainers, I was the slowest to recognize the significance of these new behaviors. Immersed in monitoring her progress in her regularly scheduled programs, I failed at first to realize that the new behaviors, particularly the hugs which we had specifically shaped, were different than other behaviors we had trained. Conspicuously absent were the usual reinforcers-- the opportunity to leave the cottage, riding motion, and especially food. Rather, our physical contact with her appeared to function as the reinforcer.

Sitting with her in the cottage one night, I sought to confirm this observation partially by calling upon her old, familiar "eye contact" response. I picked her up, swung her around several times and roughhoused her, making her laugh and grow excited. I reseated her and told her, "Look at me, Claudia." The unmistakable expression appeared; I hugged her for several seconds; and she began laughing again. I stood up and issued the command again. Once more she made "eye contact," and I hugged her; again she laughed. I repeated the sequence about ten times more, then attended several other clients for about five minutes, allowing her to settle down. I approached her again and this time I did not begin by

exciting her, rather beginning directly with the command to look at me. "Eye contact" followed the command almost immediately and continued to do so for perhaps another ten trials, at which time I terminated my "experiment." In retrospect, I could have obtained clearer evidence of the reinforcing nature of the hugs by engaging in more sophisticated behavioral analysis. I could have, for example, added another set of trials in which I ignored the eye contact, then performed a third set in which the hugs were reinstated ("ABA" design). Other manipulations would have permitted more detailed exploration, such as isolating the relevant aspects of the hugs.

Unfortunately, I did not pursue these avenues. The ideas did not occur to me at the time. I was too excited by the realization that Claudia had changed in a way that we had not even contemplated when we first observed her on the floor of Lilac. We had decreased the rumination and given her a variety of basic living skills. Now, she had developed social behaviors. They were perhaps rudimentary, but to us and to Claudia they made a difference.

The Limits of Training

We attempted to teach Claudia many things and obviously did not always succeed. In some cases, she learned well up to a point, beyond which she did not advance. In other cases, our basic or preparatory training failed, and we abandoned

altogether our efforts in those areas. There were also akills that we never even attempted to teach her.

Whenever our training was stymied, we had to ask ourselves whether the problem was our technique or whether the goal was beyond Claudia's capabilities. There was, of course, rarely a definitive answer. For almost every failed strategy several alternatives were available. These we had to weigh against her previous progress in that area, her progress in other areas, and against considerations such as probable expenditure of time, energy and money. When we tried a new tactic and succeeded, we felt vindicated. When we elected to discontinue a program, we did so with reluctance. Perhaps another day or week would have made the difference.

Review of Training Discussed Heretofore

Teaching Claudia to eat independently proved more disappointing to us than any other area of her training. Perhaps this was because she learned the basic skill, scooping with a spoon, so rapidly. In comparison, her subsequent progress seemed incredibly slow, and in some areas she never progressed. After two and a half years, we had succeeded in that she could independently eat her entire meal and drink her juice. But there was also much she could not do. She still needed a bib to collect spilled food and liquid. Although she did not scoop backhanded, her forward scoops

pushed a considerable amount of food off the plate. We had failed in teaching her to use a fork, and, based on her loose grip of the fork and her limited maneuvering of the spoon, we had not tried to teach her to cut the food. With further training, she may someday eat neatly, without a bib. But is using a fork and knife a feasible goal? At the time we tried to teach her, it was not. Perhaps the opportunity will arise again later, when she has had several more years of practice at eating by herself and if those working with her at that time have found a more effective teaching technology.

Claudia progressed neither as far nor as fast as we had hoped after the first week of her scooping program. But when we first saw her lying on the floor of Lilac, we did not even contemplate teaching her to feed herself. Considering Claudia's initial state, her feeding programs hardly failed.

Her progress in the cafeteria must be viewed likewise. She could not go through the serving line by herself and, in fact, could not wait in line for more than a minute or two. Neither, however, could many of the other clients who lived in higher level cottages. Again, she may yet learn to do these things. In my training with her, she did not.

In teaching Claudia to walk, the most successful of our training efforts, we also faced limits. I doubt that she will ever run, although her speed as she approached the cafeteria in mid-1978 cast doubt upon this prediction. A

year earlier, the prediction seemed a safe one. The triple arthrodesis operation, as well as her small stature, also render unlikely the possibility that she will learn to climb or descend stairs without supporting herself on a bannister. However, she learned essentially the same behavior in her "obstacles" program; the five-inch platform was a shallow, wide step. How much further could the program be pushed? Claudia taught us that guessing does not provide the answer.

Programs That Failed

Self-care and hygience programs were neither Claudia's forte nor ours. We attempted a toothbrushing program, based on the observation that she enjoyed having her teeth brushed, or so we naively surmised. What she enjoyed was the toothpaste. We began, as we did with most of her sessions except those dealing with walking, by physically assisting her. The simplest motion was side-to-side, but all attempts to fade the assistance produced the same result. Claudia was rapidly learning to chew her toothbrush. With this ignominious beginning, we terminated the program. Even if we could teach her simple brush strokes, how much longer would it take to teach her to brush her teeth in a manner that would do them some good? She would not benefit from what promised to be a long, frustrating program. Our efforts were better directed elsewhere.

We abandoned the toothbrushing program after several weeks, but were more tenacious in attempting to teach Claudia dressing skills. T-shirts seemed the best place to start, as

pulling on a loose fitting T-shirt requires less force than do most articles of clothing. Pulling on a shirt also lends itself well to the popular "backward chaining" method (Bassinger et al., 1971; Sundel & Sundel, 1975), in which the complex behavior is divided into a sequence of simpler responses. The last response is taught first, then the next-to-the-last response, and so on. The final response when putting on a shirt is to pull it down once it has been slipped over the head and arms. This was to be our first step in Claudia's program. Unfortunately, to pull the shirt down one must be holding it, which Claudia was not. For five months, we labored to induce her merely to hold the bottom of the shirt. We gave up about four months after we probably should have.

We did not attempt to teach Claudia any other dressing skills. In retrospect, we were probably mistaken. Pulling on socks, slipping on a coat, and other skills might have been far easier to teach than pulling on a shirt. That we did not attempt other dressing programs was no surprise. Our first, extensive efforts were thoroughly unrewarded.

We were also tenacious-- and generally unsuccessful-- in an area unrelated to basic living skills: visual assessment. When focusing on objects, Claudia's eyes diverged. Our observations indicated that she primarily used her right eye, and we sought to develop a rapid measure of visual acuity. We developed a task in which she was to choose a plain, white block over a white block with a black spot. We failed in that

we did not develop a quick measure of resolution acuity, the common means of visual assessment. However, we pursued the project for more than a year to teach ourselves about the experimental analysis of behavior. We eventually obtained a measure of visibility acuity (detecting the presence/absence of a stimulus; Christman, 1971). The results are reported in the final chapter.

Programs Never Attempted

We taught-- or attempted with varying degrees of success to teach-- Claudia many of the basic elements of human behavior. However, we made none but the most superficial efforts in two major areas, toileting and speech.

When we arrived at Lilac, all but a few of the clients were in diapers. We successfully taught basic toileting skills to some, but failed with others who were generally higher level than Claudia. Toileting is not an all-or-none behavior. Accident frequency varies widely and can be subdivided into urination and defecation accidents. Self-initiating may be beyond many clients' capabilities, but these clients can be taken out of diapers if they eliminate only when sent to the toilet on a regular schedule. Toilet training frequently requires intensive training for days, weeks, or even months.

Based on our experience with higher level clients, we felt that we would be using much valuable training time with Claudia in a program that offered little hope of success. To

keep her in or near the washroom for extended periods would conflict with her progress in walking. Further, we were actually making an effort to keep her out of the washroom since she, like many clients, drank from the toilet. It was essential to keep the drinking to a minimum, both for health reasons and because excessive liquid increased the probability of rumination.

We did, however, begin placing her on the toilet after meals to see if she might be susceptible to a schedule of regular sending. After several months, she was no more likely to urinate or defecate on the toilet than she was when we began sending her, averaging overall a fifty percent "hit rate." She showed no regular pattern of eliminating at other times during the day. We continued the practice of sending her, however, as it required little effort and did occasionally save a diaper change.

We held little enough hope for toileting, but even less for speech. Claudia was not deaf, as she demonstrated when the cottage door opened at meal times. She certainly vocalized, gurgling and crying at first, and later also laughing, but the range of vocalizations was quite limited. Despite our strenuous efforts to teach her to respond to her name, she responded to it only occasionally after hearing it repeatedly for several years. Our voices never exerted any consistent control over her behavior. In short, we had observed that some behaviors were likelier to occur than others, and speech was not one of the likely ones.

Determining the Limits of Training

Were the STARS Program to continue indefinitely, how much more could Claudia learn? The preceding sections contained speculation regarding training limits, but a definitive answer is impossible. Victor, the Wild Boy, was still learning when Itard terminated training after five years. Stoddard did not find learning limits with Cosmo, the microcephalic, after ten years (p. 18, ff.). Claudia's progress during two and a half years is perhaps only a beginning.

When we began teaching Claudia, our sole concern was to stop the rumination, and we gave little thought to what might follow. Despite our naivete, we realized that Claudia was exceptionally low functioning, even among the profoundly retarded. Thus, we expected little of her. Our initial goals for many other clients included basic speech, refined speech, toileting, and academic and preacademic tasks. For Claudia, eye contact was the first step, and that proved to be too complex. Had we speculated during the first months of training, we would not have included walking to the cafeteria and carrying a tray filled with solid food among a list of feasible goals. But Claudia was full of surprises, and the surprises never ceased. We did not anticipate the speed with which she acquired basic feeding and walking skills early in her training; her social behavior was a later surprise. As long as the surprises continue, we cannot know what Claudia's limits are.

The surprises do, however, suggest a rudimentary

criterion for predicting when the limits are reached. The criterion is simply the cessation of surprises. When one has "tried everything and nothing works," one can reasonably speculate that the limits are near. A surprise negates the speculation; lack of a surprise supports it.

One reduces surprises by carefully monitoring data, and therein lies a more precise method of ascertaining the limits of training. As one teaches a behavior or set of behaviors, the following questions arise: Is there a change in behavioral frequency ("celeration"; see Pennypacker, Koenig, & Lindsley, 1972); that is, is the rate of appropriate behavior increasing and/or the rate of inappropriate behavior decreasing? Is it possible to successfully institute phase changes requiring new or refined responses? If cueing or physical prompting is used-- as was often the case with Claudia-- can the prompt be successfully faded? Will the behavior occur in conditions other than training conditions, with or without explicit programming? Have all reasonable tactics been tried to induce the changes described in the foregoing questions?

Applying the analysis to one aspect of her ambulation training, the obstacles program (pp. 115-119 and Figure 23), we clearly did not approach Claudia's limit. We were able to introduce many phases requiring successively more complex behaviors. Within most of the phases, the frequency with which Claudia crossed the obstacles either accelerated or maintained. Simultaneously, the frequency of assistance decelerated. Although we did not monitor with charted data her proficiency

at crossing obstacles outside of the session, we noted that she began independently stepping up curbs following her training with a similar obstacle (the platform). In short, the rate at which Claudia learned new obstacle-related behaviors gave us no reason to believe that we were approaching her maximum possible performance.

In contrast, consider the data obtained during her fork program (pp. 121-123 and Figure 24). We tried two unsuccessful procedures. Although she was occasionally able to stab her food independently, the frequencies of independent and assisted stabs did not systematically change. Had we found a behavior that Claudia could not perform? We pursued only several of many possible training tactics. The data therefore suggest, but hardly confirm, a limit.

Similar analyses could be performed upon each program in each aspect of Claudia's training. In some areas, we possibly reached limits; in others, not. Our data, which guided us throughout Claudia's training, led us to the notion that "impossible" was not a viable concept. We tried, not always successfully, to approach each new program with no preconceived notion of what she could learn. We occasionally got nowhere. More often, Claudia rewarded us handsomely.

Saying Goodbye

The Author Leaves the STARS Program

In the spring of 1978, two and a half years after we created the STARS Program, I was given an opportunity to participate in a research project in another state. Saying goodbye to staff and clients was difficult. We were a tight-knit group and proud of the gains for which we had worked so hard. I fretted over the clients under my care and reviewed the program logic and procedures with those who would now be responsible.

I worried least about Claudia's training, which was to become Marsha's responsibility. Marsha and I had worked together in planning Claudia's training since the beginning of the program, and there was little to do except discuss possible future teaching efforts. Lorrie, Mardi, and Maureen, who had worked extensively with Claudia, were still in the program, and many of the remaining staff were also familiar with Claudia. She would be left in competent, caring hands.

In fact, my only major concern was a selfish one. I did not want to leave my friends; I did not want to leave my clients. I especially did not want to leave Claudia. Her progress had far exceeded my expectations, and she was still learning. I wanted to know how much more she could grow, and I wanted to be instrumental in that growth.

I vowed not to become maudlin on my last day with the program. I returned Claudia to the cottage after supper,

seated her in a chair, kissed her, and left the living wing. Halfway down the hall, I turned around and went back for one last peek through the window in the door. As she often did upon being returned to the cottage, she had walked to the window and pressed her hands and face against it. Her inquisitive, innocent expression made it too hard to leave. I opened the door, returned her to the chair, and walked out again. I looked back and again she was approaching the door. I forced myself to leave.

Claudia Leaves Lilac

Shortly after I left the STARS Program, the staff was informed that grant funds were running out, and the program would be terminated within a year. As original projections had indicated at least another two years' operating time, we had given little thought to the dismantling process. The staff immediately set about the task of reducing training time for the clients while monitoring to be sure that behavioral losses were minimized.

The STARS Program had always exclusively served clients living in Lilac. When a client was transferred to a higher level cottage, we had generally continued training for awhile, gradually reducing the amount of time and making ourselves available to consult with the new cottage's staff. Most, though not all, of the clients fared quite well in their new placements. Marsha chose the same tactic with Claudia, recognizing that it would be dangerous to leave her in Lilac without

continued training. Lilac was crowded, filled with multiply handicapped clients. Allowing her to remain there where the staff would have little time to spend with her would all but guarantee severe behavioral regression.

Working with the director of the major training department on campus, Marsha arranged a trial period for Claudia at Lily, a slightly higher level ICF/MR (Intermediate Care Facility for the Mentally Retarded) cottage. The placement was significant-- ICF/MR cottages are governed by strict federal regulations requiring a higher staffing ratio, better physical facilities, and more programming time for the clients than are found in non-ICF/MR units. During the trial period of several weeks, Claudia spent her days at Lily and continued to sleep at Lilac. The trial period was successful, and in September, 1978, Claudia was accepted for residency at Lily. In February, 1979, all Lily clients were moved so that Lily could undergo ICF/MR-directed renovation, scheduled for completion in 1980. Claudia and her Lily peers thus currently reside at Hope Cottage. During the Lilac-to-Lily transition period, Marsha, too, left the STARS Program, and Lorrie, Mardi, and Maureen assumed responsibility for Claudia's training.

Claudia functions at a somewhat lower level than most of her Lily/Hope cottagemates. Many can speak, respond to spoken commands, and are toilet trained. ICF/MR regulations specify that clients will not wear diapers, and Claudia was therefore placed in pants. She is sent to the toilet regularly, and is reported to have "few" accidents; Lily/Hope staff estimates

are one or fewer per day. Whether this is the result of her previous "sending" program, or whether the staff simply sends her often enough (she does not eliminate frequently), we do not know, but her toileting behavior is acceptable to the cottage personnel.

ICF/MR clients do not attend the campus cafeteria, but Claudia's cafeteria and feeding programs were essential in her placement. The cottage staff gradually replaced STARS trainers in her feeding program. When Claudia moved to Lily, STARS trainers were with her for about two hours per day and ten to fifteen meals per week. By January, 1979, STARS time was reduced to about 15 minutes following breakfast and lunch on weekends, and the Lily/Hope staff was completely responsible for the mealtime program. While the cottage staff is not currently collecting data, it is insuring that Claudia retains eating and related skills. For example, clients are required to carry their trays into the kitchen after meals, and at this task Claudia is quite proficient. Additionally, anecdotal information indicates further reduction in the number of Claudia's spills while drinking.

As the STARS workers reduced their time with Claudia, it was necessary to find activities to fill the vacancy created in her schedule. Mornings were no problem: Julia still arrives daily to take Claudia out. Their outings should be sufficient to maintain most of Claudia's ambulation skills. Afternoons proved to be more difficult. In October, 1978, Claudia was briefly enrolled in the Sunland school, where she

was given generally unstructured gross motor tasks. Her enrollment was terminated after about a month. The school, like STARS, is funded by 89-313 grant monies, and regulations forbid clients simultaneously to receive services from two 89-313-funded organizations. In addition, Claudia's school setting did not provide structured, individualized training. Not surprisingly, Claudia failed to progress in school.

By early February, 1979, STARS time with Claudia was sufficiently reduced to allow her to re-enter school without 89-313 funding conflict. It is to be hoped that she will receive more structured training than she did previously so that she can remain in school.

Claudia's programming time is not limited to excursions with Julia and attending school. She continues to participate in STARS field trips, and former STARS staff who have taken jobs elsewhere on the campus visit her and take her for off-cottage and off-campus outings.

The chief concern of all of us who worked with Claudia is, of course, the rumination. The remaining STARS time is devoted to teaching the Lily/Hope staff to monitor the rumination and maintain the cheek-hold procedure. Since the cottage staff does not keep a rumination chart, the success of maintaining control will be difficult to judge. Claudia still does not ruminate often in the presence of STARS trainers (Figure 27, phase N). Much of the apparent charted increase in frequency is an artifact of the charting procedure: frequencies of zero are charted according to the amount of

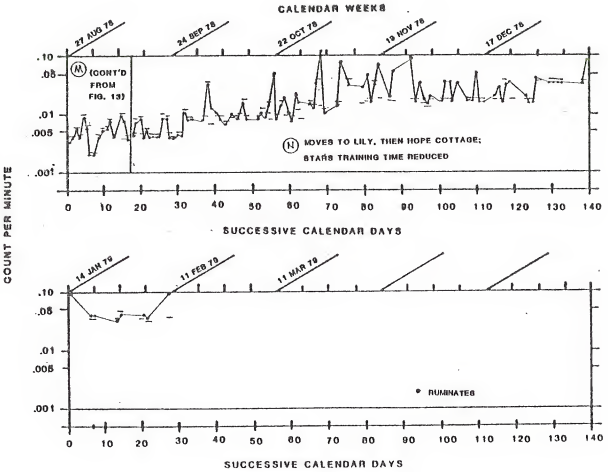

Fig. 27. Rumination. Data are continued directly from Fig. 13. Note that at least part of the apparent increase in frequency is due to higher record floors, which represent decreased STARS training time.

training time; less training time raises the estimated frequency.

However, there are also more days now during which Claudia does ruminate in the presence of a trainer. Cottage personnel report that they implement the cheek-hold procedure, although not as consistently as did STARS trainers. The available data thus suggest that the rumination is increased when trainers are not present. Efforts are underway to rectify the problem. STARS trainers are teaching the Lily/Hope staff the importance of consistent intervention. The task is not easy. Rumination is common at Sunland and is not a significant problem for many clients who ruminate at a low frequency and do not evidence weight loss. To the cottage staff, Claudia is one such client. She is healthy, does not ruminate often, and her weight is stable at 85 to 90 pounds (see Figure 6b, p. 48). We observed the problem before among staff who began working with the STARS after Claudia's rumination was already under control. Now the Lily/Hope staff must learn about the consequences of failing to intervene. Their learning is the key to the fruition of nearly three years of work with Claudia.

Final Considerations

Claudia is undergoing major environmental changes. In 1975, she was deteriorating in the Lilac environment. She thrived in the subsequent Lilac/STARS environment, and continued to thrive as she made the transition to the Lily/Hope/STARS milieu. Soon, formal STARS input to her training will

be terminated. To date, she is doing well. Her new circumstances seem supportive of the changes we induced in her.

She is required to feed herself and carry her tray, so the feeding and related skills should maintain and perhaps improve. She will probably retain most of her ambulation skills under Julia's auspices and because of her old trainer-friends' visits. However, formal ambulation training has been terminated, and she walks shorter distances, over fewer obstacles than she did previously. Some of her skills may deteriorate. Her social behaviors may or may not maintain. She receives less attention and physical contact than she did during intensive STARS training. But she still sees Julia and the other grannies, her friends visit, and the higher level Lily/Hope clients attend to her more frequently and appropriately than did her Lilac peers. A positive sign is that she now spends more time sitting on the couch with her cottagemates, an improvement over her preference for the Lilac day room floor.

Her continued wellbeing hinges upon the rumination. Here, the data are less definitive. She is currently healthy, but more time is needed to determine whether the cottage staff can control this salient aspect of Claudia's behavior.

I continue to worry and wonder what the future will bring for Claudia, and I fervently hope for the best for her. We taught her many things, but she gave us much more in return. She taught us, inspired us, and we came to love her dearly. Between visits, I'll miss her.

CHAPTER III
DETERMINATION OF VISUAL THRESHOLD[1]

Claudia's eyes diverged and informal observations by her trainers indicated that her right eye was dominant. At her yearly eye examination in 1977, the doctor confirmed that, based upon measures of light refraction, her left eye vision was probably considerably poorer than that of her right eye. He also commented that adequately assessing the vision of individuals functioning at Claudia's level was a difficult task. We became interested in the problem and attempted to devise a procedure that would relatively rapidly and accurately assess Claudia's vision. We realized within several weeks that, at least for Claudia, the procedure was not a quick, convenient one. We continued to pursue the problem, however, as we were curious to discover whether we could calculate any sort of visual threshold measure. Claudia's extensive training schedule allowed us ample time to spend the several minutes per day necessary to conduct the visual training and testing.

Assessing the vision of severely retarded, handicapped individuals is difficult, primarily because many such individuals do not respond to verbal instructions. In addition,

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[1]The author wishes to thank Dr. C. K. Adams for his encouragement and consultation throughout this project. His assistance was indispensable in developing the final experimental procedure.

these individuals may be easily distracted, and their handicaps can severely limit the nature of the response used for assessment (Faye, 1968; Langley & DuBose, 1976). The problem is particularly important since visual impairment frequently accompanies retardation and other handicaps (Blackhurst & Radke, 1968; Wolf & Anderson, 1973; Langley & DuBose, 1976).

Available techniques for assessing handicapped populations generally require responses that are too complex for profoundly retarded individuals. The responses are commonly centered around choosing or matching various toys, simple shapes, and pictures (Faye, 1968; Lippman, 1969). For lower functioning individuals, operant assessment procedures are more promising since the response is usually simple to execute and primary reinforcement insures that the subject will emit enough responses to be assessed. Sidman and Stoddard (1967; and Stoddard & Sidman, 1971), for example, were able to obtain visual acuity measures from retarded subjects by establishing a circle-ellipse discrimination and gradually making the ellipse more circular. Macht (1971) developed a procedure in which lever presses caused a circle to rotate. Subjects learned to upright a Snellen E printed on the circle.

Newsom and Simon (1977) reported a simpler procedure. The response involved walking down one of two short passageways and touching a stimulus card at the end of the passageway. One passageway contained S+, originally a card with vertical black and white stripes, faded in two steps to a Snellen E rotated 90° (pointing downward). The other

passageway contained S-, originally a blank card, faded in 18 steps to a backwards Snellen E. Praise and an edible reinforcer were delivered for each correct choice; the child was told to sit down each time he or she entered the wrong passageway. Progressively smaller stimulus pairs were used to determine visual resolution acuity. Of eleven nonverbal, autistic and schizophrenic Ss, eight were successfully trained and tested, each requiring no more than three hours (one to three sessions). The remaining three Ss failed to make a horizontal-vertical stripe discrimination during training and could not be tested.

Method

Training the Basic Response

We chose depositing blocks in a can as the basic response. When we began training we were not sure what the final test stimuli would be. We preferred instead to postpone this decision until we isolated a visual dimension to which Claudia would reliably respond and that we could accurately quantify in increments small enough to obtain a discrimination measure. We decided only that the task would involve choosing one of two blocks over repeated trials.

We trained Claudia to pick up a 2.54-cm^3 (one cubic inch) wooden block and deposit it in an empty peanut butter can (institutional size, 17.78 cm diameter). Training required three days, ten minutes per day. Claudia initially reached for the block and picked it up when it was placed in

front of her; the trainer merely guided Claudia's hand over the can and induced her to release the block. She received a spoonful of food for each block deposited. During the first day, Claudia needed assistance of this nature on approximately one block per minute, while she independently deposited about four blocks per minute. By the third day, she needed assistance with only two blocks (0.2 blocks per minute) and independently deposited seven blocks per minute. She used her right hand almost exclusively during training and throughout the study.

We next constructed the experimental apparatus, a 45.72-cm length of two-by-four board, to which we glued two small plastic cups, 15.24 cm apart. The cups were filled with Play Dough so that each wooden block would protrude 1.59 cm above the cup rim. The entire apparatus was painted gray.

The trainer and Claudia sat on the floor facing each other across a small coffee table, on which the trainer placed the apparatus, and to Claudia's right, the peanut butter can. The trainer placed one block at a time into one of the cups, alternating cups. During the first day, Claudia repeatedly grabbed both block and cup, ripped the cups off the board. We fortified the apparatus and repainted it. The next day we began with the block on the tabletop, next to the apparatus. Over ten trials (one trial = depositing one block in the can), we moved the block from the tabletop, onto the apparatus (but not in the cups), and finally into the cups. During the

remainder of the session, she deposited 55 blocks in ten minutes, 40 seconds, grabbing the cup 20 times in the process. The frequency and apparent (but unmeasured) force with which she grabbed the cup decreased during the session and were no longer a problem at the end of the session. The problem did not reappear during the course of the study.

Discrimination Training

Discrimination training and testing were conducted in Lilac's lounge. Sessions began between 4:00 and 4:30 p.m. and usually lasted seven to ten minutes. Claudia's schedule usually permitted three to five sessions per week. The sessions were conducted before her other afternoon training sessions to minimize fatigue and maximize the effects of the reinforcer. The window curtains were closed during the sessions so that the only light source was overhead fluorescent lighting. Light level on the apparatus was 16 foot-candles (measured with light meter installed in Honeywell Pentax Spotmatic camera). During the first half of the training phase, Claudia was seated at the coffee table, as described above; during the second half of training and throughout testing, she was seated in the relaxation chair. She maintained a constant posture in the relaxation chair, head slightly tilted forward, eyes 40 - 45 cm from the stimulus blocks. Other trainers and clients, staff, and visitors were occasionally in the lounge but were apparently not distracting; Claudia rarely looked up while the sessions were in progress.

The discrimination task involved lifting and depositing in the can one of two blocks (S+, S-) presented simultaneously in the apparatus cups. The trainer tallied correct and incorrect responses on a record sheet which indicated whether S+ was placed in the right or left cup. Sessions consisted of 40 trials (increased to 60 trials during the final testing phase) of random right and left placements. The randomization was modified to insure an equal number of right and left placements and that S+ was never placed on the same side more than four times in succession. The trainer timed each session with a stopwatch, beginning the timing when the first pair of stimulus blocks was presented and ending the timing when the final block was deposited in the can. The watch did not run during timeout periods (see below). Data were thus available regarding the number and frequency of S+ and S- choices, as well as regarding conditional probabilities (probability of choosing S+ in right versus left cup, etc.).

The first training phase involved discriminating solid white (S+) and solid black (S-) blocks. Each time Claudia deposited the S+ block in the can, she was given a spoonful of food; if she picked up the S- block, the trainer took it away before she could deposit it and removed the apparatus (timeout, TO) for 15 seconds. Immediately following either food delivery or 15 second TO, the next pair of blocks was presented. Thus, although the session consisted of discrete trials, or block presentations, the trials occurred as rapidly as Claudia's and the trainer's behavior permitted, rather than

on a time-based schedule. At first Claudia chose S+ more frequently than S-, but the discrimination deteriorated rapidly (Figure 28, phase A)[1].

A large part of the problem appeared to be that Claudia was "grabby" between trials. As soon as she deposited a block and received a reinforcer, she began reaching for the apparatus and would take the first block inserted into a cup. We used a cardboard screen for several days in an effort to alleviate the problem. Although her performance improved, (phase B), the grabbing continued, this time directed at the screen. When the trainer removed the screen, Claudia frequently took the block nearer her hand. We eliminated the screen and solved the problem by instituting a "distracting response" (phase C). Before each trial, the trainer placed an orange wooden block (one cubic inch) in front of the apparatus. While Claudia deposited the block in the can, the trainer arranged the stimulus blocks. A trial therefore consisted of depositing one orange and one stimulus block. No training was required to induce Claudia to deposit the orange blocks. This arrangement remained in effect for the duration of the study.

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[1]While Fig. 28 records the frequency of S+ and S- choices, percent correct is readily derived. Where 0 S- responses are indicated, percent correct is obviously 100. In other cases, percent correct is calculated by obtaining the ratio of S+ to S- choices; on the logarithmic frequency scale, the ratio is the distance between S+ and S- frequencies. Percent correct = (ratio) ÷ (ratio + 1). For example, if S+ rate = 6 per min. and S- rate = 2 per min., ratio = 6 ÷ 2 = 3, and percent correct = 3 ÷ 4 = 0.75, or 75%.

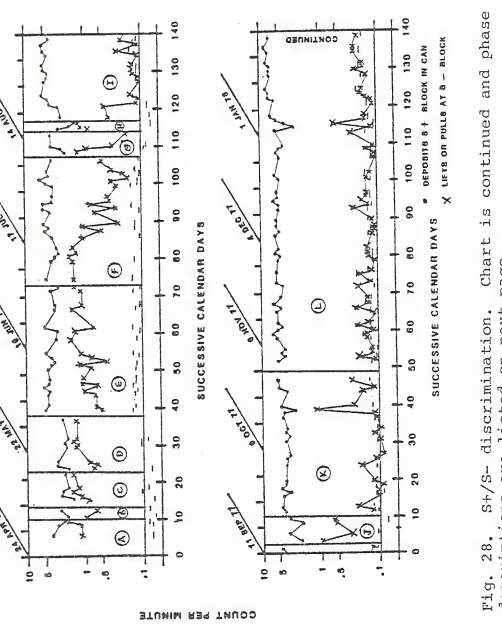
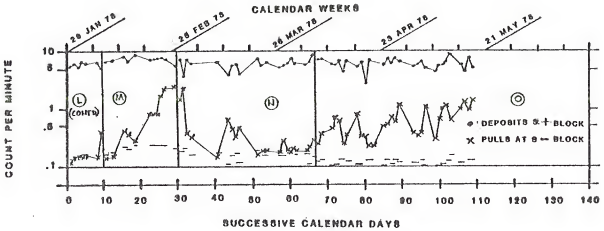


Fig. 28. S+/S- discrimination. Chart is continued and phase descriptions are listed on next page.

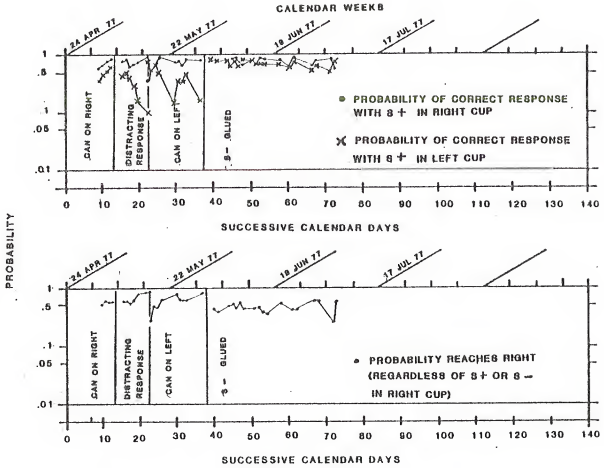


A. S+= white block (crf); S-= black block (TO 15 sec). 40 trials per session
B. Apparatus screened between trials.
C. Distracting response; deposit orange block between trials.
D. Switch can from right to left side.
E. S- glued to cup. Allowed Claudia to correct errors without consequence.
F. TO 15 sec. for touching S-.
G. S+=black block; S-=white block covered with gray tape.
H. Tape and glue removed from S-. TO 15 sec. for lifting S-.
I. Gray tape strip on S-. S-glued; TO 15 sec. for touching S-.
J. S+=white block; S- same as above (glued white block with tape strip).
K. Sessions in relaxation chair. Tape strip only on block (not also on cup lip).
L. Velcro patches replace glue. Tape strip faded to black patch on top of S-.
M. First test phase. VR2 for S+ choices; TO 15 sec. for S- choices (S-=black dots).
N. Retraining using tape patch and larger S- dots. 60 trials per session.
O. Second test phase VR2 for S+ choices; TO 15 sec. for S- choices.

Fig. 28, continued. Phase descriptions summarized above.

Although the grabbing was greatly reduced, Claudia reached for the stimulus block on her right in a disproportionately high number of trials. The side preference had existed since the start of training, but worsened shortly after we introduced the distracting response. It is not clear whether the distracting response and the preference were related. The side preference is illustrated in Figure 29a, the probability of a correct response when S+ was in right versus left cup, and Figure 29b, the probability with which Claudia reached for the right block regardless of whether the block was S+ or S-. When Claudia reached for the right block nearly 100% of the time, we placed the can on her left side. Although the preference temporarily disappeared, it soon returned (Figure 28, phase D; Figures 29 a,b). We now glued the S- block into one of the cups and rotated the entire apparatus to effect right and left presentations. The side preference disappeared permanently (Figures 29 a,b).

When we glued the S- block, we removed the TO contingency since Claudia obviously could not lift the incorrect block. Instead, we let her pull at the S- block and correct her error; she received reinforcement for depositing the S+ block whether or not she had first pulled at the S- block. Her performance gradually deteriorated (Figure 28, phase E). We altered the contingencies; depositing S+ still resulted in reinforcement, but the apparatus was removed for 15 seconds (TO) as soon as Claudia's hand touched S-. After a week her performance began improving (phase F).



Figs. 29a, b. Fig. 29a (top): Probability of correct response with S+ in right/left cup. Note that X's are not targeted for decrease. Fig. 29b (bottom): Probability of reaching toward block in right cup.

When she was responding to S- about 0.25 times per minute (about three responses per 40 trials), we reversed S+ and S- so that S+ was now the black block. S-, the white block, was covered entirely by gray tape. The same contingencies were in effect; depositing the black block resulted in reinforcement and touching S- (actually the gray tape) resulted in a 15 second TO. Although the S- block was not even visible, she reached frequently at first for the gray tape (phase G). She rapidly learned to pick up the black block, and we removed the tape from S-. We did not glue the white block, however, Instead, if she picked it up, it was taken away from her and a 15 second TO ensued, (same procedure as that of phase A, except S+ = black and S- = white). Her performance rapidly degenerated (phase H).

Since Claudia had learned so quickly to avoid the block with gray tape, we retaped the white block (phase I). This time, however, the tape was a strip 1.59 cm thick, running from the lip of the cup over the top of the block and down to the lip on the opposite side, so that the tape formed a vertical gray stripe over the block. We then decreased the thickness of the tape in steps, 0.64 cm, 0.32 cm. and 0.16 cm. At 0.16 cm we colored the tape black. Apparatus removal for 15 seconds contingent upon touching S- was reinstated. The S- block was glued during this phase, as the thin tape strip could not prevent her from removing the block if she grabbed it firmly before the trainer could remove the apparatus.

We finally realized that the tape could be used to establish a discrimination for threshold measurement. A white

block with black tape was still S-, and S+ became a plain white block (phase J). We began conducting sessions in the relaxation chair and removed the part of the tape fastened to the lip of the cup. Instead, the tape ran over the top of the block and down its sides. Claudia performed almost errorlessly (phase K). We gradually removed the tape from the sides of the block (phase L), running it 1.27 cm down each side, then just barely over the top edges of the block, finally shortening and widening the tape until it was roughly hexagonal, 1.27 cm long and 0.79 cm wide, on top of the block. We also removed the glue and replaced it with Velcro patches to hold S- firmly in place. Nonstick material was placed on S+ blocks to equate the height of S+ and S-. Thus, S- could be moved from cup to cup between trials, eliminating the possibility that Claudia could be responding to some aspect of the cup in which S- was placed. We were ready to begin testing.

Testing, Retraining, and Retesting

We prepared the series of test stimuli. A white block continued to serve as S+, and the S- series was a set of nine blocks, each white with a black (India ink) circle in the top center of the block. The circle diameters were: 0.56 cm (7/32 inch), 0.48 cm (3/16), 0.40 cm (5/32 inch), 0.32 cm (1/8 inch), 0.24 cm (3/32 inch), 0.16 cm (1/16 inch), 0.12 cm (3/64 inch), 0.08 cm (1/32 inch), and 0.04 cm (1/64 inch). The stimuli are henceforth designated 7, 6, 5, 4, 3, 2, 1, 0.5. All S- blocks were equipped with Velcro patches.

We switched to a VR2 schedule of reinforcement,

anticipating that Claudia would begin making errors as the stimuli approached her threshold; all errors still resulted in a 15 second TO (phase M). We began using only block 7 and over several days introduced blocks 6, 5, and 4. The same stimulus was presented over four consecutive trials, and the order of stimuli was mixed (e.g., four 7's, four 4's, four 6's, etc.). The procedure was thus a variation of the constant-stimulus and constant-stimulus difference methods popular in psychophysics (Christman, 1971).

Each session was 40 trials as was the case during training. As Claudia was making few errors at any of these S- values, we eliminated the 7 and 6 blocks and inserted eight trials with the 3 block, then eight trials with the 2 block. On the day we added the 2 block, her error frequency was 1.8 per minute; the previous day it had been 0.9 per minute. Most of the errors occurred on the 2 block. The next day her error frequency rose again, and again most of the errors occurred on the 2 block. The following day, although she made more correct than incorrect responses, the discrimination was largely lost, as errors appeared at all S- values. We had probably added the smaller S- dots too rapidly.

We consequently undertook retraining (phase N). We returned to reinforcing every correct response and used only blocks 6, 5, and 4. We did not regain control, and therefore eliminated blocks 5 and 4 and added an S- block with a black tape patch similar to the tape patches used prior to testing. This was sufficient to reestablish control, and we eliminated the tape patch, returned to a VR2 reinforcement schedule, and

included trials using blocks 5 and 4. We increased the number of trials per session to 60 and eliminated the 6 block. We were again ready to test, i.e., add blocks 3, 2, 1.5, 1, and 0.5. The entire retraining process had taken five weeks.

During the second testing period (phase O), which lasted six and a half weeks, we added the smaller S- blocks at a slower rate than we had previously. In addition, we presented a given S- only twice in succession, taking care to present larger dots immediately before and after the smaller ones. Claudia's error rate never exceeded 1.5 per minute. During the final several weeks of testing, each session consisted of 30 presentations of the 5 block, six 2's, eight 1.5's, eight 1's, and eight 0.5's (the 3 and 4 blocks were eliminated as Claudia nearly always responded correctly; the 5 block remained to insure that she did not lose the discrimination).

Testing was discontinued at the end of May due to major structural changes in the STARS Program. Consequently, threshold values were never determined for right and left eyes separately.

Results

The results of the second testing series (phase O; 4/7/78-5/19/78) are displayed in Figure 30. The data are divided into four curves according to the dates listed on the figure. The divisions were chosen as follows: Triangles represent data taken when blocks 5, 4, 3, 2, 1, were used; squares represent data taken on all seven blocks; filled circles are

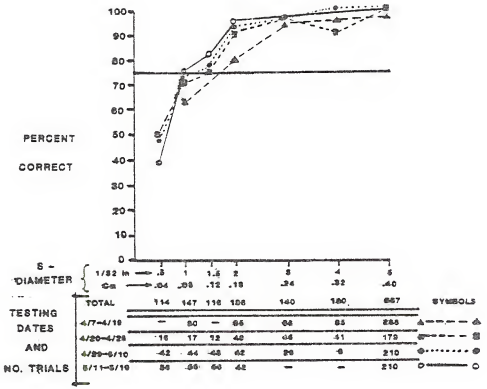


Fig. 30. Percent correct choices as a function of diameter of S- dot. The four curves represent data taken during successive periods of testing, as indicated in the key, above. The columns containing numbers of trials correspond to the S- dot sizes under which the columns appear.

data taken on all seven blocks, but while the 4 block was being eliminated, open circles represent data taken on blocks 5, 2, 1.5, 1, 0.5.

The curves move generally upward through time, indicating that Claudia was becoming progressively more sensitive to the smaller stimuli. However, the last two curves are extremely close; she was probably discriminating maximally. Since the procedure involved choosing one of two blocks, 50% correct is not an appropriate threshold criterion. Instead, the threshold line is taken to be 75%. The line passes precisely through the 0.08 cm value for the last of the curves; her threshold is therefore 0.08 cm. At 42.5 ± 2.5 cm from Claudia's eyes, the threshold stimulus subtended 0.108 ± 0.006°, or 6.47 ± 0.40 min of visual angle.

Using the 6.47 min of visual angle subtended by the threshold stimulus, it is possible to approximate the familiar Snellen acuity ratio. The Snellen ratio for "normal" vision, 20/20, indicates that the subject can resolve a separable angle of one min; 20/40 means that the subject requires twice the normal separation, or two min; 20/200 is a ten-min angle, and so on. Since Claudia reliably detected a stimulus subtending 6.47 min of angle, the approximate Snellen ratio is 20/130. For the purposes of comparison, in most states, an individual must have corrected vision of 20/40 or better to obtain a driver's license; persons with corrected vision of less than 20/200 are considered legally blind (Massachusetts Department of Medical Affairs, personal communication).

The ratio calculated for Claudia must be interpreted cautiously, however. Resolution acuity, which the Snellen ratio measures, refers to the subject's ability to detect a separation between the components of a stimulus. For example, all segments of the Snellen "E" are one min in width, and each segment is separated by a one-min space. In comparison, Claudia was detecting the presence/absence of a single-component stimulus, a circle. To obtain a more accurate estimate of the Snellen ratio for Claudia, we would have had to use multi-component stimuli, for example, two horizontal stripes and two vertical stripes.

Discussion

Although we successfully established a visual threshold for Claudia, the study was a failure in several respects. The original aim was to devise a rapid (several days to several weeks) means of measuring visual acuity. The project lasted just over a year and produced a measure of visibility acuity (presence/absence of a stimulus) that can only tenuously be converted to the common measure of visual functioning, resolution acuity. The procedure would presumably have taken less time with higher level clients and would also likely require less time to replicate with a client of Claudia's level, based on what we learned from the present study. However, the procedure devised by Newsom and Simon, discussed in the introduction, requires less time and directly produces a resolution acuity ratio. Thus, Newsom and Simon's procedure would

probably be the method of choice with higher functioning clients.

For individuals functioning at Claudia's level, those who would not likely be testable with other procedures, more data are required regarding the usefulness of the present procedure. By how much could the procedure be shortened? What problems might be involved in testing each eye separately? We successfully trained Claudia to wear a patch on either eye in anticipation of the present study, but whether she would have performed the discrimination task, particularly with her dominant eye covered, is a matter of speculation. The problems encountered during the study would certainly lead one to suspect that testing the weaker eye would have produced further problems.

A different line of questioning addresses the usefulness of detailed visual assessment for lower functioning individuals. In the absence of procedures such as those discussed in the introduction, an opthamologist's examination, requiring no behavior from the subject other than keeping the eyes open, reveals gross impairments or physical damage to the eyes. How much further information is useful or necessary? Claudia functioned well enough in her regular training sessions. How much, if at all, better would she have fared were her vision assessed and corrected? Would she have learned to walk more rapidly with corrected vision, especially in programs such as step-climbing and obstacles, which required her to discriminate edges and contours? The answers to such

questions require a means of testing and correcting vision. The present study is a beginning.

The study was also useful in another sense. All of us involved in it learned much about the experimental analysis of behavior. We were tempted to abandon the study many times, particularly since it was not an integral part of Claudia's training. However, the problem intrigued us, and the sessions required little time per day. We were disappointed that we did not achieve our original aims, but we were not sorry that we attempted the project.

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BIOGRAPHICAL SKETCH

William Hartman was born April 30, 1950, in Chicago. He grew up in the Chicago area and graduated in 1968 from Deerfield High School, Deerfield, Illinois.

Mr. Hartman majored in psychology at Oberlin College (Oberlin, Ohio), where he received his Bachelor of Arts degree in 1972. In late 1972, he entered the graduate psychology program at the University of Florida. He studied the experimental analysis of behavior with Dr. H. S. Pennypacker, stressing applications in higher education, with children, and with developmentally disabled individuals. He received his master's degree in 1975.

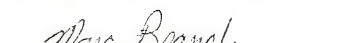
In 1978, while continuing his graduate studies with Dr. Pennypacker, Mr. Hartman assumed the positions he currently holds: chief psychologist at the Eunice Kennedy Shriver Center for Mental Retardation in Waltham, Massachusetts, and visiting assistant professor of psychology at Northeastern University. He provides psychological and behavioral assessments and consultation in a community clinic for the developmentally disabled and teaches in a graduate program regarding behavior analysis/retardation.

Mr. Hartman received his Ph.D. in psychology from the University of Florida in 1979.

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Henry S. Pennypacker, Chairman
Professor of Psychology

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.



Marc Branch
Associate Professor of Psychology

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

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James Johnston
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I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Dorothy Nevill
Associate Professor of Psychology

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

John Newell
Professor of Foundations of Education

This dissertation was submitted to the Graduate Faculty of the Department of Psychology in the College of Liberal Arts and Sciences and to the Graduate Council, and was accepted as partial fulfillment of the requirements for the degree of Doctor of Philosophy.

December, 1979

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Dean, Graduate School